DRAFT

Evaluating and Comparing Proposed Water Management Actions

February 2002

CALFED BAY-DELTA PROGRAM

A Component of the Water Management Strategy Evaluation Framework

Contents

Section 5 Findings and Future Applications

Appendices

Section 1
The CALFED Water Management Strategy Evaluation Framework

1.1 Introduction

From 1995 to 2000, agencies and stakeholders participating in the CALFED Bay-Delta Program produced a broad set of water management actions described in the CALFED Programmatic Environmental Impact Statement and Report (EIS / EIR) and a preferred alternative set forth in the August 2000 CALFED Record of Decision (ROD). These actions are expected to restore the ecological health and improve the beneficial uses of the San Francisco Bay / Sacramento-San Joaquin Delta estuary.

Recently, the CALFED Bay-Delta Program began implementing Stage 1 of its long-term program, covering the 7 years following the ROD. While the ROD provides an agreed-upon approach to water management actions, it does not offer details about how actions, or combinations of actions, should be designed. Much work remains to determine whether specific water management actions should or can be implemented, and there are differing views on how to implement actions outlined in the ROD. As a result, there are many combinations of potentially competing water management strategies to consider.

How will policy makers and stakeholders move CALFED from general to specific actions?

What is needed to support sound, broadly endorsed policy recommendations? When considering multiple options that could help meet CALFED objectives, how does one choose which options to implement? These are difficult questions. The answers depend on the circumstances, details, and consequences of choosing one option over another. Sorting through the circumstances, getting to the details, and learning the potential consequences of choices and decisions are the primary reasons CALFED has invested in the Water Management Strategy (WMS) Evaluation Framework.

This report provides an overview of the tools and methods supporting the WMS Evaluation Framework and some pertinent examples of their output. The remainder of this first section presents some of the issues that motivated CALFED to develop and test the WMS Evaluation Framework. It also summarizes some of the tasks required to move beyond the programmatic ROD actions toward implementing specific water management strategies.

Section 2, *A Comprehensive Approach*, introduces the methods and tools used to predict and compare performance of different water management actions. Section 3, *Example Alternatives,* describes an initial set of alternative water management strategies that were developed to give CALFED participants some tangible (rather than abstract) alternatives to evaluate. Section 4, *Comparison and Evaluation of Example Alternatives*, demonstrates how the evaluation framework can be used to compare the relative merits of competing water management strategies. Section 5, *Findings and Future*

Applications, ends with general findings and next steps in refining the WMS Evaluation Framework.

1.2 The Water Management Strategy Evaluation Framework

The WMS Evaluation Framework addresses the need to comprehensively evaluate potential actions on a technically consistent basis. It represents an organized methodology that CALFED participants can use to:

- Predict possible impacts from proposed water management actions;
- Evaluate those impacts with respect to CALFED objectives and solution principles;
- Learn more about water management system responses to various actions;
- Help answer pressing policy questions (such as "Who are the beneficiaries of a proposed water management action?");
- Identify tradeoffs among alternatives to help people choose which water management strategy best meets their needs; and
- Improve investment benefits by discovering more efficient combinations of water management actions.

The WMS Evaluation Framework is designed to provide a consistent and thorough process to help policy makers and stakeholders identify, select, and implement specific water management actions, or combinations of actions, consistent with the CALFED ROD. For example, the storage program element in the ROD specifies expanding storage capacity (from between 1.45 to 1.95 million acre-feet). The actions outlined identify certain existing reservoirs for expansion but do not identify specific groundwater storage projects. Instead, the ROD promotes facilitating development of locally supported, managed, and controlled groundwater and conjunctive use projects. To determine how these projects should be combined with surface storage projects and existing water project operations, policy makers and stakeholders will need to answer such questions as:

- How much water will the project provide?
- How will the water that is produced be used?
- Who are the beneficiaries, and are there redirected impacts?
- How much will the project cost?
- Who will pay for the project and how?

- How will the project affect other system elements, such as water quality and ecosystem needs?
- How will the project interact with existing facilities, or other projects that are being considered?

These questions apply for all water management strategies, whether or not they include storage, water conservation, ecosystem restoration, or water quality improvement actions. Their answers will play an important role in determining whether proposed actions can be implemented.

The WMS Evaluation Framework organizes a broad range of useful information to help policy makers and stakeholders learn the nature and details of the tradeoffs, evaluate competing alternatives, and decide which strategies offer the best course of action in implementing the ROD.

1.2.1 Status of the WMS Evaluation Framework

While much work has been done to develop methods and tools to use as part of the WMS Evaluation Framework, much work remains. The goal is to develop evaluation methods (and the data and analytical tools needed to apply the methods) that are relevant and responsive to the future needs of policy makers and stakeholders.

1.2.2 Use of the WMS Evaluation Framework

The approach used in the WMS Evaluation Framework predicts likely outcomes without offering value judgments regarding the desirability of alternatives. Findings are presented in terms of relative performance, not in terms of whether one alternative is “better” than another. By presenting the information without presenting value judgments, the WMS Evaluation Framework allows policy makers and stakeholders to evaluate and compare alternative water management strategies

Definitions

Water Management Actions – individual physical or policy changes to the existing water management system (such as adding new storage or conveyance facilities or revising policies governing operation of facilities)

Water Management System – the collection of physical facilities and policies that are used to manipulate California’s water resources

Alternatives – various combinations (or packages) of water management actions

Water Management Strategy – a combination of water management actions designed to improve performance of the entire water management system

WMS Evaluation Framework – structured approach to compare performance of alternative water management strategies relative to CALFED objectives and solution principles

Solution Principles – a set of six solution principles that are recognized as additional fundamental stakeholder objectives, including reducing conflict, being equitable, affordable, durable, implementable, and avoiding redirected impacts

Comprehensive Analysis Approach – method to study system interactions using linked models to compare expected changes in water allocation, water quality, groundwater, and economic conditions according to their own preferences, based on a neutral presentation of predicted performance.

Development of the WMS Evaluation Framework involved four tasks:

- Definition of specific objectives;
- Identification of relevant performance measures;
- Prediction of performance for proposed water management alternatives; and
- Comparisons of their relative performance.

The first two tasks (define specific objectives and identify performance measures) were completed at the CALFED programmatic level and are discussed in a report titled *Water Management Strategy Evaluation Framework* (December 1999). The 1999 report presents a list of the performance measures that stakeholders and policy makers asked to have available to help them evaluate and compare the impacts of proposed water management actions.

1.2.3 Next Steps

What will it take to move beyond the programmatic recommendations of the CALFED ROD to implement specific water management actions? The answer to this question depends on the specific actions being considered, but in most cases progress requires the following:

1. A comprehensive understanding of the proposed actions by:
   - Defining specific purposes;
   - Predicting economic and system impacts; and
   - Evaluating how well the proposed actions satisfy the specific purpose.
2. Broad support among policy makers and stakeholders developed by:
   - Communicating the knowledge gained in a useful context;
   - Complying with environmental and permit requirements; and
   - Establishing viable ways to finance the actions.

Accomplishing these tasks requires relevant and timely technical information. Given diverse (and often conflicting) stakeholder views, this process is likely to be both dynamic and challenging. While project teams (made up of CALFED agency representatives, local interests, and stakeholders) focused on specific water management proposals will be responsible for much of this work, these teams will share a common need to refine data and analytical tools, and examine ways to improve interactions among these tools. This report presents an update on the development of analytical tools, illustrates how their output may be used for comparison of alternatives, and presents a summary of findings developed to date.

Section 2
A Comprehensive Approach

When evaluating alternative water management strategies, policy makers and stakeholders want some indication of how alternative strategies will perform in the future. The comprehensive approach adopted in the WMS Evaluation Framework provides predictive information about alternative strategies in terms of benefits or impacts to fisheries, ecosystems, water quality, water deliveries, or Delta outflow. This information can be evaluated in the context of the specific purposes of the project and CALFED objectives to help policy makers and stakeholders determine which alternatives should be implemented, as well as contributing to the understanding of trade-offs that could be considered in arriving at compromises among competing interests. This section outlines the approach used to evaluate alternative water management strategies and their potential impacts.

Any comprehensive evaluation of proposed water management strategies must consider hydrologic variations, the operation of complex physical facilities, legal requirements, established policies, and other factors. The impacts of new facilities, changing operational practices, and/or management policies in the Bay-Delta system affect not only the Delta, but also areas north and south of the Delta, much of the Central Valley, and urban areas of the San Francisco Bay area and the Central and South Coasts.

Policy makers and stakeholders have requested a broad array of information to help determine if proposed changes to the system meet the objectives of the CALFED program. In addition to supply benefits and costs, they are interested in water quality, groundwater conditions, fisheries, land use, and urban and agricultural economics.

Development efforts to date have concentrated on predicting performance for a limited set of initial alternatives, using performance measures previously identified by policy makers and stakeholders[1]. The comprehensive analysis approach utilized in the development of the WMS Evaluation Framework has relied upon several existing models, developed independently over more than a decade, that represent complex system interactions such as system operations and Delta water quality. The analysis team linked these models, using custom data management processors, in order to simulate the interrelationships of the corresponding factors in the real system.

[1] *Water Management Strategy Evaluation Framework* (CALFED, December 1999).

2.1 Conceptual Model

To understand this detailed modeling approach, it is important to understand the system it is intended to simulate. The Bay-Delta is the hub of California's two largest water distribution systems - the Central Valley Project (CVP) operated by the U.S. Bureau of Reclamation and the State Water Project (SWP) operated by the California Department of Water Resources (DWR). The modeling effort is based on a conceptual model, which focuses on the seven major geographical regions affected by these systems.

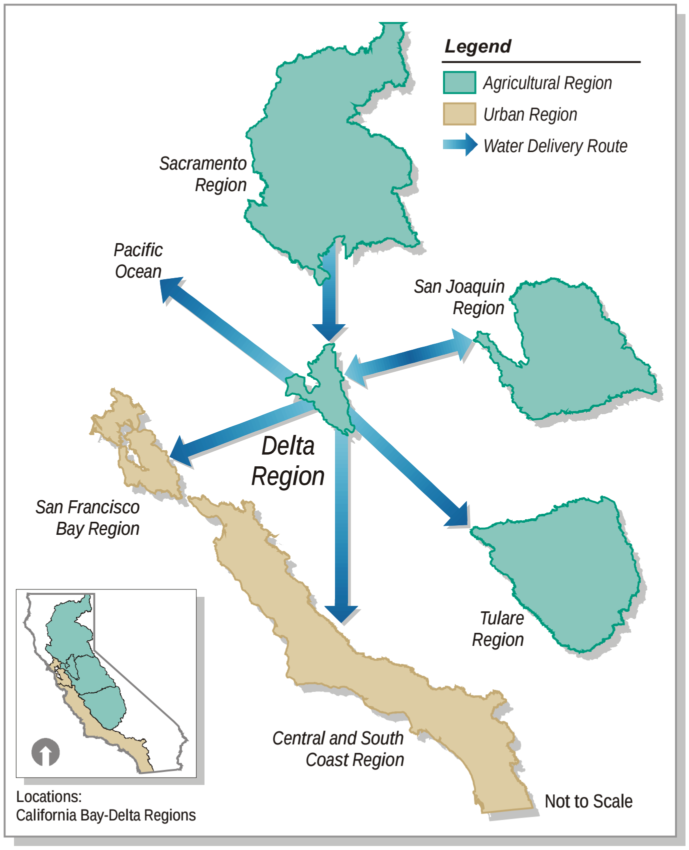

Figure 2-2
Conceptual Bay-Delta System

Figure 2-1 on the following page illustrates the State of California, the geographic regions included in the analysis, and various CVP and SWP waterways and projects. This analysis considers urban and agricultural land and water uses within each region. To simplify the presentation and analysis of results, the San Francisco Bay and South Coast regions are considered to be primarily urban regions, and the Sacramento, San Joaquin, and Tulare regions are primarily agricultural. The Central Coast has smaller levels of development, so it is included with the South Coast. Figure 2-2 illustrates the conceptual Bay-Delta system, as represented by the model.

Appendix C contains more detailed information regarding the conceptual model and the planning assumptions.

2.2 Modeling Approach

Figure 2-3 illustrates the primary elements included in the analysis and the general relationships of the elements with respect to data exchange. Figure 2-4 shows a more detailed representation of how the analyses were performed outlining the analysis topics, model inputs, interrelationships, and results. Appendix A contains additional detail on the models described below.

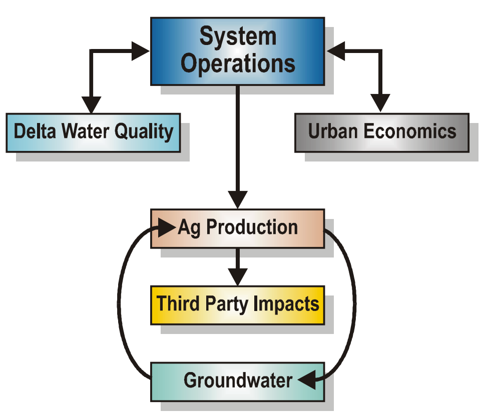

Figure 2-3
Primary Analysis Elements

CALFED BAY-DELTA PROGRAM

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Figure 2-1
California Waterways and Water Projects
Evaluating and Comparing Proposed Water Management Actions

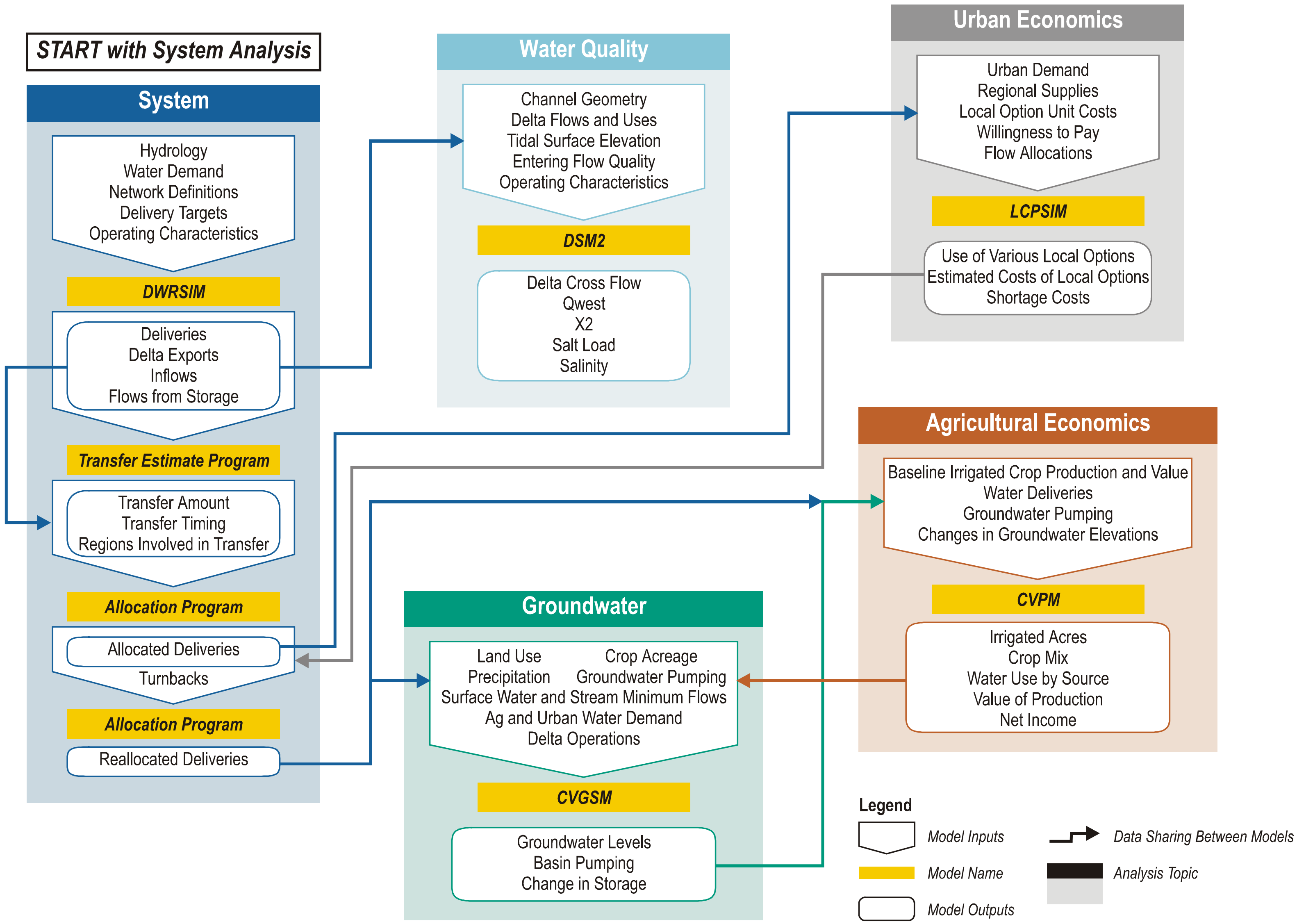


Figure 2-4 Comprehensive Evaluation Schematic

2.2.1 System Operations

The initial step in the analysis simulates the hydrologic conditions, hydraulics and operations within the regions of the Bay-Delta system. System operations analyses were performed using the DWR Simulation Model (DWRSIM), along with post-processing analyses to estimate transfers and allocate water supplies. DWRSIM simulates interactions among the rivers, reservoirs, and export structures that are part of the SWP, CVP, and local water supply projects.

DWRSIM's representation of the system incorporates delivery targets, storage facilities, conveyance facilities, and Delta operational requirements (e.g., Delta export pumping restrictions). The model simulates operations resulting from proposed water management actions to produce estimates of corresponding impacts to reservoir storage, Delta flows, and deliveries. The system operations analysis is the backbone of the comprehensive analysis approach, in that the subsequent modeling efforts expand on these results to predict additional performance information for each alternative.

2.2.2 Water Quality

The water quality analysis addresses the hydrodynamics and water quality of the Delta to a much greater level of detail than the system operations analysis. The Delta Simulation Model II (DSM2) was used to perform this analysis. DSM2 analyzes a detailed representation of the Delta's conveyance system, as well as tidal flows and seasonal variability. Using flow information built upon the results of the systems operations analysis, the water quality analysis predicts salt loading and concentrations throughout the Delta.

2.2.3 Urban Economics

Deliveries from the Bay-Delta are only one part of the supplies used to meet the demands of large metropolitan areas in California. Changes in expected deliveries from the Delta system affect how metropolitan areas will respond to meet future water demands. The Least-Cost Planning Simulation Model (LCPSIM) uses water deliveries and projected demands to provide estimates of how the Bay Area and Central and South Coast will respond to projected deliveries from the Bay-Delta. Using data from the system operations model, this analysis predicts the levels of conservation, recycling, groundwater pumping, desalination, and additional shortage that are likely to be implemented in urban areas. The urban economic analysis estimates the costs of regional water supply development options, as well as the costs resulting from predicted shortages.

2.2.4 Groundwater

Expected impacts on regional groundwater are modeled using the Central Valley Ground-Surface Water Model (CVGSM). The analysis examines the hydrology of the Central Valley to predict groundwater conditions for different alternatives. Changes in surface water deliveries and agricultural production that impact pumping rates and groundwater levels are primary considerations. Because agricultural production in the Central Valley depends on both surface water and groundwater supplies, these analyses are closely linked (Figure 2-3).

2.2.5 Agricultural Production

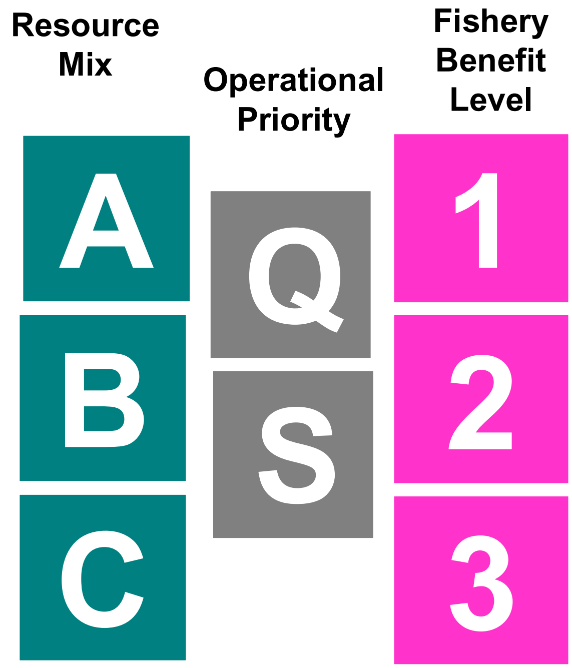
The agricultural production analysis is performed using the Central Valley Production Model (CVPM), a regional model of irrigated agriculture within the Central Valley. Using agricultural flow allocation data from the system operations model, this analysis predicts changes in the agricultural production that are likely to occur. The agricultural production analysis predicts the changes in crop acreage, water use, and the impact on gross agricultural revenues by region.

2.3 Using the Models

The comprehensive analysis tools are designed to improve understanding of the relationships among deliveries, economics, water quality, and fisheries in the Delta. By applying these tools in a consistent and reproducible manner, the evaluation can provide informative estimates of the relative performance of different alternatives.

To test the comprehensive analysis approach, CALFED defined an initial set of alternative water management strategies comprising combinations of ROD actions and evaluated them. Section 3 summarizes the initial alternatives.

Section 3
Example Alternatives



A water management strategy (WMS) is defined as a combination of specific actions designed to improve the performance of the Bay-Delta system. Potential actions considered include both physical changes (such as additional surface storage or groundwater storage) as well as policy changes (such as establishment of the Environmental Water Account). CALFED worked with policy makers and stakeholders to define several reasonable WMS alternatives that would serve to: (1) allow the continued development of analytical tools, and (2) provide an opportunity to learn about how the Bay-Delta system might respond to various combinations of water management actions.

Identifying reasonable WMS alternatives required establishing a number of planning assumptions. The assumptions used to build alternatives are discussed below, as well as in Appendix C.

3.1 Example WMS Alternatives

There are a variety of specific actions available to accomplish water management objectives in the Bay-Delta system. These actions can be organized into many different combinations. Because the number of combinations that can be evaluated in a given time is limited, the comprehensive analysis approach was tested using a subset of promising alternatives. In developing alternatives, the specific water management actions were grouped into three categories:

- ***Three resource mixes*** that include varying amounts of surface storage, conjunctive use, and transfers. The different resource mixes are named “A,” “B,” and “C.”
- ***Two operational priorities*** for water quality and water supply. The priorities are referred to as “Q “ for water quality and “S” for supply.
- ***Three levels of fishery benefits*** represented in terms of increasing restrictions on Delta export pumping. The ascending levels of pumping curtailment are referred to as “1,” “2,” and “3.”

Each alternative (other than existing and no action) is based on one of the resource mixes, one operational priority, and one level of fishery benefits. For example, alternative “CS3,” combines Resource Mix C, operations emphasizing water supply benefits, and fishery benefits level 3.

3.1.1 Resource Mixes

The resource mixes include water management actions based on three central themes:

- **Resource Mix A** incorporates intensive demand side management to keep Delta exports at 1995 levels and contains no new surface storage facilities.

- **Resource Mix B** allows Delta exports to increase and incorporates new surface storage. Additional supply benefits resulting from water management actions are allocated to urban users as the first priority in this mix.

- **Resource Mix C** also allows increased Delta exports and includes new surface storage. In this mix, the additional supply benefits are allocated in the same priority as existing water contracts.

The resource mixes all incorporate conjunctive use and rely on varying amounts of water transfers. The expected level of reliance on water use efficiency measures is estimated based on the Delta delivery patterns resulting from the implementation of each alternative. Table 3-1 lists the main components of Resource Mixes A, B, and C.

Table 3-1
Comprehensive Evaluation Resource Mixes

Resource Mix	***North of Delta***				***South of Delta***		***Allocation Priority***
	New Surface Storage Facilities (TAF)	***GW Total Storage Volume (TAF)***	***Transfers to the Environ-ment (Max TAF/ year)***	***Transfers to Urban Users (Max TAF/ year)***	***GW Total Storage Volume (TAF)***	***Transfers to Urban Users (Max TAF/ year)***	
A	None	500	500	100	1,800	500	Urban then Ag
B	2,288	500	500	300	1,800	500	Urban then Ag
C	2,288	500	500	100	1,800	200	Existing Priorities

Each resource mix is a unique combination of water management actions and limiting assumptions. The primary features of Table 3-1 are explained below.

- **Surface Storage**: If surface storage is included in a resource mix, raising the height of the dam at Lake Shasta and a new Sites reservoir are the potential facilities improvements included. The Shasta enlargement is assumed to provide an additional 288 TAF of storage, and the Sites reservoir is assumed to have a capacity of 2.0 MAF.

- **North of Delta Groundwater Storage**: Groundwater storage sites and capacities are based on estimates in the *Conjunctive Use Site Assessment*[1]. All three resource mixes assume the same amount of conjunctive use storage North of the Delta.

- **North of Delta Environmental Transfers**: The analysis assumes limits on all transfers based on both perceived feasibility and policy considerations. The upper limit on environmental transfers from North of the Delta is estimated at 500 TAF annually. Transfers will vary by year depending on need but are never allowed to exceed this limit.

- **North of Delta Urban Transfers**: Upper limits were assumed for transfers from North of Delta agriculture to South of Delta urban or agricultural users. These limits are set lower for Resource Mixes A and C, reflecting potential legislative limits to protect the environment or agricultural users.

- **South of Delta Groundwater Storage**: The availability of south of Delta groundwater storage is also based on estimates in the *Conjunctive Use Site Assessment*. All three resource mixes utilize the same amount of conjunctive use storage South of the Delta.

- **South of Delta Transfers**: An upper limit for transfers from South of Delta agricultural users to South of Delta urban users was estimated for each resource mix. Resource Mix C has a lower cap to reflect potential legislative action to reduce the transfer of water from agricultural use.

- **Allocation:** The resource mixes reflect two different allocation methodologies. Resource Mixes A and B allocate additional water to urban users before agricultural users, assuming a greater willingness-to-pay. Resource Mix C allocates water to meet existing project contracts and distributes any excess proportionally.

In addition to the elements shown in Table 3-1, Resource Mix A also includes an upper limit for SWP deliveries of 3.5 MAF. This cap approximates 1995 export levels and is imposed to simulate a greater investment from SWP water users in water use efficiency measures. As noted above, water use efficiency investments are estimated by the urban economics analysis as a response to predicted shortages rather than being set as an explicit component of a given resource mix. The assumed cap on SWP deliveries would drive users to increase utilization of local projects, and reflects the emphasis of Resource Mix A on water use efficiency.

Two additional variations on the resource mixes were examined as part of the comprehensive evaluation. These variations were developed in response to specific stakeholder requests. For Resource Mixes B and C, in which the proposed Sites reservoir is included, a minimum flow requirement in the Sacramento River was set before water was allowed to be diverted to fill the reservoir. This minimum flow

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[1] *Conjunctive Use Site Assessment* (CALFED, December 23, 1999)

requirement is assumed to be 10,000 cfs. Because some stakeholders suggested that the requirement should be higher, a sensitivity study was performed on Resource Mix C. It examined an alternative that was identical to Resource Mix C, except that it included a minimum flow requirement of 20,000 cfs. This variation is designated in results tables (Appendix B) by a "_20" appended to the alternative name. Further, Resource Mixes B and C, in which surface storage was included, were also evaluated without their surface storage components. This variation is designated in results tables (Appendix B) by an "-NSS" appended to the alternative name.

Three CALFED studies contributed to the formulation of the resource mixes. They were:

- The *Economic Evaluation of Water Management Alternatives* (EEWMA)[2], which used preliminary technical feasibility and costs for several water resource options to assess stakeholder preference and economic feasibility. The EEWMA concluded that some potential water management actions enjoyed broad stakeholder support, and these well-supported options are included in all resource mixes. Where options had divergent levels of support, the resource mixes reflect varying levels of investment in those options.

- The *Boundary Mapping Analysis* applied a series of interconnected models to test possible combinations of water resource options and determine which combinations were both technically and economically feasible. The Boundary Mapping Analysis results showed a similar pattern to those seen in the EEWMA.

- The *Conjunctive Use Site Assessment* examined conjunctive use sites and determined which of them could be viable additions to WMS resource mixes. This assessment estimated storage capacities, recharge and recovery rates, and costs; and it was used to set the amount of conjunctive use storage incorporated within the resource mixes.

3.1.2 Operational Priorities

Because exports from the Delta are used for drinking water throughout the state, water quality is of great concern to municipal and industrial water users. Typically, the months of April through July have the best water quality for drinking water taken from the Delta. During these months, natural outflows are high enough to push seawater out of the Delta, and pollutant loading from upstream agricultural drainage is not at its peak. Because several species of fish also migrate through the Delta during this period, however, Delta exports have been shifted to fall months when water quality is lower. Recognizing this conflict, CALFED recently conducted a modeling

[2] *Economic Evaluation of Water Management Alternatives* (CALFED, October 1999)

study to explore potential water management actions designed to improve drinking water quality[3].

As part of the study, modelers tested the response of the Bay-Delta system under differing salinity requirements and recommended operational changes that could result in improved water quality. Appendix C provides additional detail on the assumptions used for these analyses.

Alternatives that contain operating strategies for improving water quality in the Delta are denoted with a "Q." Alternatives that do not include these quality-based operating strategies are denoted with an "S" to indicate that the system was operated to emphasize water supply benefits.

3.1.3 Fishery Benefits

Within the current WMS Evaluation Framework, there is no performance measure available that directly indicates how changes in water supply and water quality affect fish and wildlife. Pumping curtailment schedules are used as a surrogate to reflect actions that promote fishery health and to quantify the potential impacts on the system from operating to achieve those benefits. The pumping curtailment schedules indicate the number of days per month that the combined SWP and CVP Delta exports are restricted to a total of 2,250 cfs in order to maintain river flows for fishery purposes. The days with reduced pumping are concentrated in months that benefit fish the most (December through June, with a peak in May).[4]

Based on analyses performed prior to the CALFED ROD for the Environmental Water Account, three pumping curtailment schedules were chosen for inclusion in the example alternatives, and are referred to as "fishery benefits" levels 1, 2, and 3[5]. Table 3-2 shows the fishery benefits levels and their associated reduced pumping schedules.

Table 3-2
Pumping Schedules for Different Levels of Fishery Benefits

Fishery Benefits Level	Days of Reduced Pumping											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	-	-	-	-	-	-	16	24	8	-	-	-
2	-	-	-	8	-	8	24	24	16	-	-	-
3	-	-	8	8	-	8	24	31	24	-	-	-

Fishery benefits Level 1 is the least restrictive pumping schedule and is assumed to provide the fewest potential fishery benefits. Level 3 is the most restrictive pumping schedule and provides the greatest potential fishery benefits. Each resource mix was

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[3] *Drinking Water Quality Operations Studies for the Water Management Strategy Comprehensive Evaluation* (CALFED, December 14, 1999)

[4] This modeling effort was prior to the formulation of the Environmental Water Account. Subsequent studies will incorporate the latest approach.

[5] *Export Operations Flexibility Analysis* (CALFED, December 23, 1999)

modeled for the three reduced pumping schedules in order to assess the impacts of more restrictions to Delta exports for fishery protection.

3.2 Existing and Future No Action Conditions

In order to provide several baselines for comparative analyses, alternatives were developed that represented existing conditions and examined no action under a variety of assumptions. The "EXIST" alternative represents "existing" conditions with 1995 water demand and 1995 Delta export levels. A "no action" alternative, designated as "NA," assumes 2020 demands and 2020 Delta export levels without any additional water management actions. A third alternative, designated "EXIST_NA," assumes growth to 2020 demand levels but holds Delta exports at 1995 levels.

The EXIST_NA alternative represents the expected increasing urban demands on the SWP, while limiting Delta exports to those allowed under the current biological opinion. Three more no-action alternatives were formulated by adding the pumping restrictions to reach fishery benefits Level 1 (EXIST_1, NA_1, and EXIST_NA_1).

The no action alternative EXIST_NA_1 was selected as the base case for comparison with the example alternatives presented in this study. This no action alternative is referred to as BASE throughout the rest of this report.

Section 4
Comparison and Evaluation of Example Alternatives

Initial development and testing of the comprehensive analysis data and tools was conducted using 32 alternatives. Appendix B contains summary results for all of these alternatives analyzed. This section focuses on example results, primarily from Alternatives AQ3, BS1, and CS1. The information is intended to illustrate not only the types of analyses that may be performed, but also some useful comparisons that can help in understanding the tradeoffs that are possible among various potential water management actions. The three alternatives selected for comparison are described below:

- Alternative AQ3 includes water management actions likely to be beneficial for accomplishing environmental objectives (intensive demand side management, operation priority given to improving Delta water quality, and high level of Delta pumping restrictions designed to benefit fisheries).

- Alternative BS1 includes water management actions likely to be beneficial to urban regions (new surface storage, operation for water supply benefits allocated first to urban water users, and least restrictive Delta pumping).

- Alternative CS1 includes water management actions likely to be beneficial to agricultural regions (new surface storage, allocation of new water supply benefits based on priority of existing contracts, and least restrictive Delta pumping).

These three alternatives represent a fairly broad range of approaches for meeting the CALFED objectives and serve as good examples of the types of choices and outcomes that are encountered when comparing various water management strategies.

This section begins with a brief description of the demands by sector. Results of note regarding deliveries to each sector are then included, followed by discussions regarding resource contributions, transfers, water availability, and costs and benefits. The detailed results from the comprehensive analysis are included in the data spreadsheets in Appendix B.

4.1 Demands by Sector

4.1.1 Agricultural Demands

The agricultural areas studied in the example alternatives included the Sacramento, San Joaquin, and Tulare regions. Projected demands for the San Joaquin and Tulare regions are included in the model as the basis for target deliveries. The Sacramento region is north of the Delta, and does not receive deliveries from the Bay-Delta system. These target deliveries are determined based on SWP and CVP contracts, as discussed in Appendix C. Table 4-1 shows the average annual target deliveries for the

San Joaquin and Tulare regions. In the comprehensive analysis approach, these target deliveries are first met by deliveries from the SWP and CVP facilities or interruptible supplies. The model assumes that voluntary transfers occur. If surface water sources are not available, the models assume that farmers pump groundwater for irrigation if it is cost effective in the short-term. If the region has voluntarily transferred some of its allocation, however, no groundwater substitution is allowed for the water that was transferred.

Table 4-1
Agricultural Target Deliveries
(TAF/year)

Region	***Average Annual Target Deliveries***
San Joaquin	1,442
Tulare	2,448

4.1.2 Urban Demands

Urban demand for water from the Bay-Delta system is somewhat more difficult to predict than the demand from the agricultural sector, because urban areas use water from several sources. The urban demand in the Bay Area and South Coast urban regions is predicted using two different models: an allocation model and an urban economics model (Appendix C). Table 4-2 contains the average annual target deliveries for water from the Bay-Delta system for the Bay Area and South Coast regions as derived from the urban economic model.

Table 4-2
Target Deliveries to Urban Areas
from Bay-Delta System

Urban Region	***Average Annual Target Deliveries (TAF/Year)***
Bay Area	339
South Coast	2,077

The allocation model results indicate the amounts of SWP and CVP deliveries, SWP interruptible supply, and voluntary transfers to urban areas; however, these deliveries do not always satisfy the demand. The urban economic model determines the amount and type of regional options that should be used to match a region's needs, either by increasing supply or reducing demand. The urban economic model utilizes the total annual water demand for the South Coast and Bay Area regions. This demand is represented as an economic demand curve, where the quantity demanded changes in response to changes in the cost of water. The urban economic model attempts to meet the total demand by considering:

- Expected deliveries from existing local facilities;
- Expected deliveries from external supplies other than the Bay-Delta system (such as the Colorado River);

- Expected demand reductions from local conservation efforts;
- The timing and amounts of Bay-Delta system deliveries; and
- The potential for developing additional local supply (or demand reduction) options.

Upon considering all of these potential supply or demand reduction options, the urban economic model selects additional regional options until the cost of implementing the next option would exceed the benefits. These regional options are often implemented to provide water in dry years when less is available from the Bay-Delta system. In the model, however, if the options are implemented, they provide water in all years. The regional options, therefore, decrease the target deliveries needed from the Bay-Delta system over many years.

4.1.3 Environmental Demands

Environmental water demands include water quality in the Bay-Delta system. Many of these demands result from existing regulatory requirements. The CALFED Ecosystem Restoration Program includes additional instream flow targets in system rivers and streams, as well as additional Delta outflow targets. These flows apply to specific periods of time. Assumptions for regulatory requirements and ERP flows are represented the same way in all alternatives (except the BASE case). See Appendix C for additional detail on regulatory requirements.

The fishery benefit component of the alternatives incorporates another type of environmental demand. Reduced Delta pumping provides additional water for fish during certain months, and is included as a component of environmental demand. The fishery benefits are variable. As noted in Section 3, three pumping schedules were modeled within the initial set of alternatives, to examine the effects of providing various levels of fishery benefits.[1]

4.2 Deliveries

Figure 4-1 illustrates the flow of water through the areas modeled for the BASE case. This figure shows all Delta inflows, outflows, and deliveries as they are modeled in the comprehensive analysis approach.

All of the example alternatives provide some increase in Bay-Delta system deliveries over the BASE case. Total simulated deliveries from the Delta are shown in Figure 4-2 for three alternatives and the BASE. Total Bay-Delta system deliveries under the BASE case average 4,486 TAF annually over the long-term period. Alternative AQ3 provides a 2 percent increase (100 TAF) in average annual total Delta deliveries above

[1] This modeling effort was prior to the formulation of the Environmental Water Account. Subsequent studies will incorporate the latest approach.

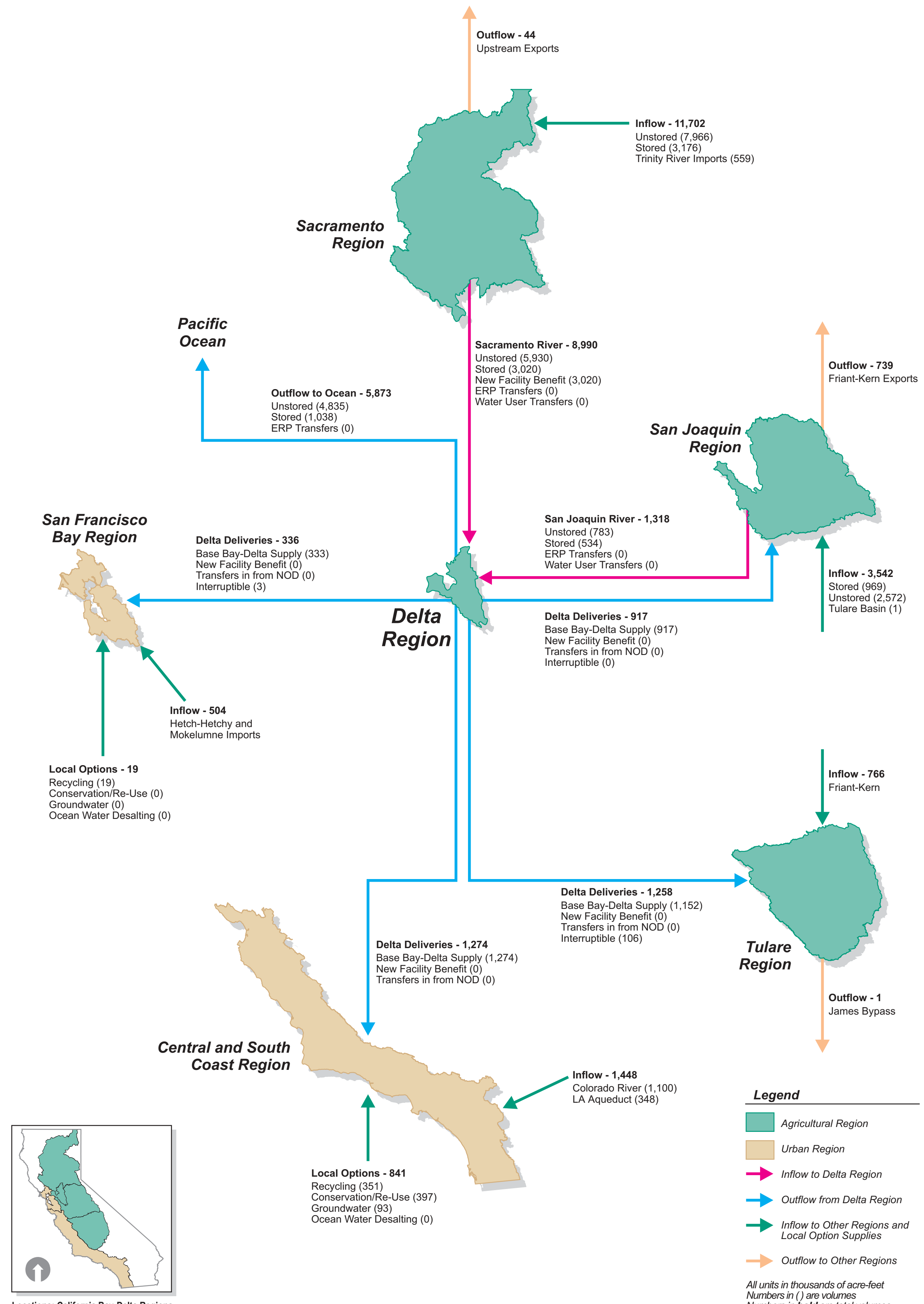

Figure 4-1
Bay-Delta Water System:
Water Budget Base Case for Dry and Critical Years

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the BASE, whereas Alternatives BS1 and CS1 provide increases of 18 percent and 17 percent (790 TAF and 770 TAF) above the BASE, respectively. Total Delta deliveries under the BASE alternative include base deliveries and interruptible water supplies. Alternatives AQ3, BS1, and CS1 include base deliveries, interruptible water supplies, north-of-Delta transfers to urban water users, and benefits from the respective resource mixes (hereafter called new facility benefits).

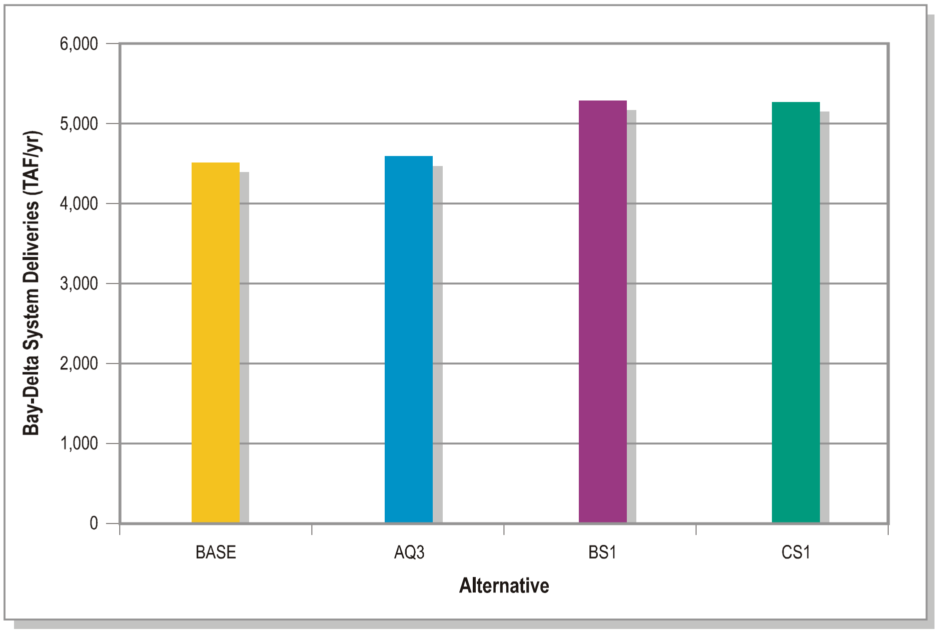


Figure 4-2 *All example alternatives result in increased Bay-Delta system deliveries over the BASE alternative.*

4.2.1 Agricultural Deliveries

Agricultural deliveries to the San Joaquin and Tulare regions increase the most under alternative CS1, which allocates new facility benefits based on the priority of existing contracts. Figure 4-3 compares the San Joaquin region's target deliveries to water deliveries under alternative CS1. Target deliveries are met more often under CS1 than other alternatives or the BASE case, but they are fully met less than 1/5 of the years modeled. Figure 4-4 shows the target deliveries that would not be supplied in the San Joaquin Region during conditions similar to the years 1926 though 1936. This simulated time period includes several dry or critical years, and shows that alternative CS1 results in fewer demands that are not supplied.

When target deliveries from surface water are not met, some farmers depend on groundwater to provide the remaining water they need. Groundwater overdraft is a significant concern throughout California, and the WMS Evaluation Framework includes performance measures to assess how the alternatives may impact groundwater. In general, areas that receive less surface water will rely more heavily on groundwater.

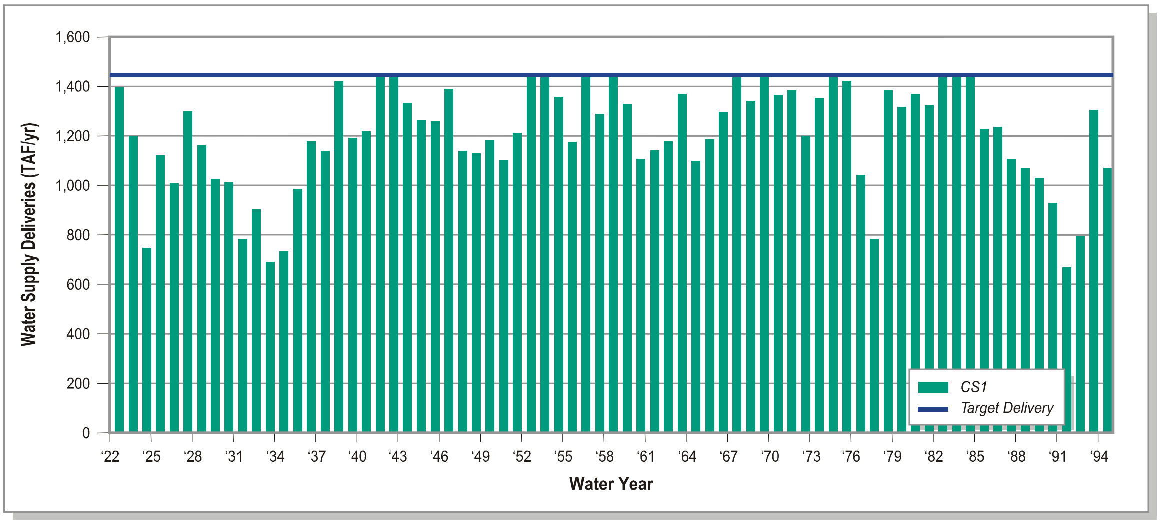


Figure 4-3 *Target deliveries to the San Joaquin region are met more often in CSI than BASE, but still less than 1/5 of years.*

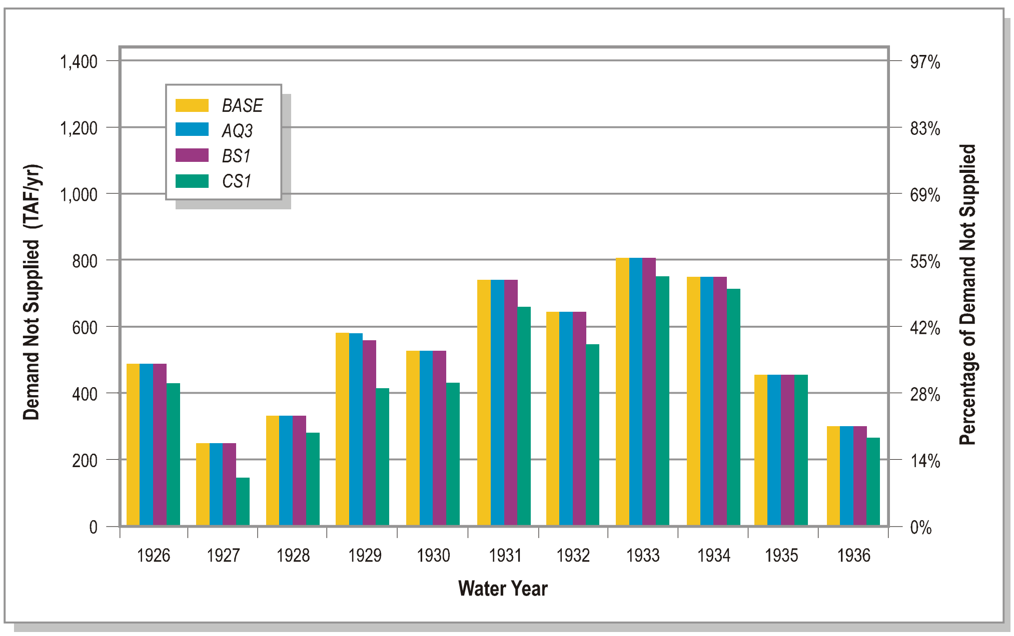


Figure 4-4 *Alternative CS1 more closely meets target deliveries in the San Joaquin region than other example alternatives.*

Note: This figure illustrates simulated deliveries to the region from CVP and SWP supplies and interruptible supplies before transfers are made.

4.2.1.1 Groundwater Effects

The comprehensive analysis produced groundwater results for three agricultural regions in the Central Valley: Sacramento, San Joaquin and Tulare. The results do not project major changes for the Sacramento Region for any alternatives. The Tulare region, on the other hand, is much more reliant on groundwater pumping and is projected to have relatively large changes in storage in response to the resource mixes.

Table 4-3 illustrates the long-term average annual change in groundwater storage for each of the three regions. Groundwater storage decreases under the base case as well as all alternatives. While these results indicate that none of these example alternatives fully address groundwater overdraft concerns, groundwater storage decreases substantially less than the BASE case under alternative CS1 in the San Joaquin and Tulare regions. Alternative CS1 delivers more surface water to these regions, and therefore less groundwater is needed.

Table 4-3
Long-Term Average Annual Change in Groundwater Storage (TAF/year)

Region	*Base*	*AQ3*	*BS1*	*CS1*
Sacramento	-3	-3	-4	-3
San Joaquin	-38	-46	-29	-24
Tulare	-302	-340	-249	-195

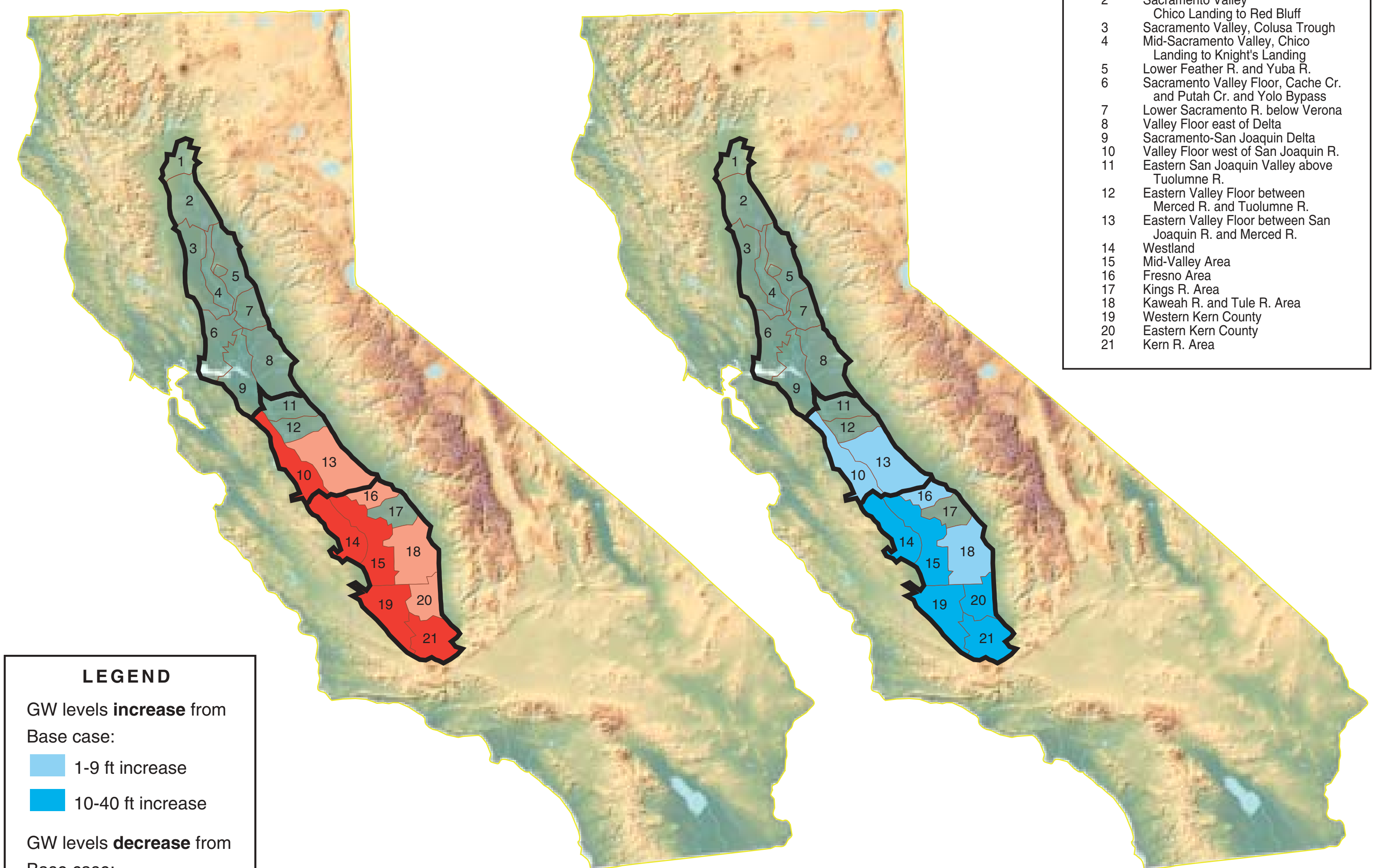
Figure 4-5 illustrates the changes in groundwater levels from the BASE case for alternatives AQ3 and CS1. The figure shows groundwater levels increasing or decreasing from the base case, but does not indicate that groundwater levels are increasing or decreasing over time.

4.2.2 Urban Deliveries

The frequency and magnitude of the difference between target and simulated urban deliveries varies considerably between alternatives. In response to the expected long-term deliveries from the Bay-Delta system, the urban economics model selects a set of cost effective regional options to better meet the water demand for the region. The regional options that are considered in the example alternatives include conservation, recycling, groundwater, and desalination beyond the amounts presumed to already be in place in 2020. The urban economic model selects the set of regional options for implementation that results in the lowest cost to the region when considering the cost of implementing the options and the cost of not meeting the target deliveries (referred to as shortage costs).

Alternative BS1 provides the largest increase in urban deliveries from the Delta over the BASE case. Figure 4-6 shows the simulated deliveries from the Bay-Delta system to the Bay Area urban region for BS1 as compared to the target delivery. Figure 4-7 displays target and simulated deliveries for the South Coast urban region. Unlike the Bay Area, the target deliveries from the Bay-Delta system to the South Coast urban

AQ3 CS1



CVGSM Subregion	Description
1	Redding Basin
2	Sacramento Valley Chico Landing to Red Bluff
3	Sacramento Valley, Colusa Trough
4	Mid-Sacramento Valley, Chico Landing to Knight's Landing
5	Lower Feather R. and Yuba R.
6	Sacramento Valley Floor, Cache Cr. and Putah Cr. and Yolo Bypass
7	Lower Sacramento R. below Verona
8	Valley Floor east of Delta
9	Sacramento-San Joaquin Delta
10	Valley Floor west of San Joaquin R.
11	Eastern San Joaquin Valley above Tuolumne R.
12	Eastern Valley Floor between Merced R. and Tuolumne R.
13	Eastern Valley Floor between San Joaquin R. and Merced R.
14	Westland
15	Mid-Valley Area
16	Fresno Area
17	Kings R. Area
18	Kaweah R. and Tule R. Area
19	Western Kern County
20	Eastern Kern County
21	Kern R. Area

LEGEND

GW levels **increase** from Base case:

- 1-9 ft increase
- 10-40 ft increase

GW levels **decrease** from Base case:

- 1-5 ft decrease
- 6-12 ft decrease

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Figure 4-5
Groundwater Level Variations
Evaluating and Comparing Proposed Water Management Actions

region are rarely met completely. In periods when the target deliveries are not fully met, Alternative BS1 usually provides more deliveries than the BASE.

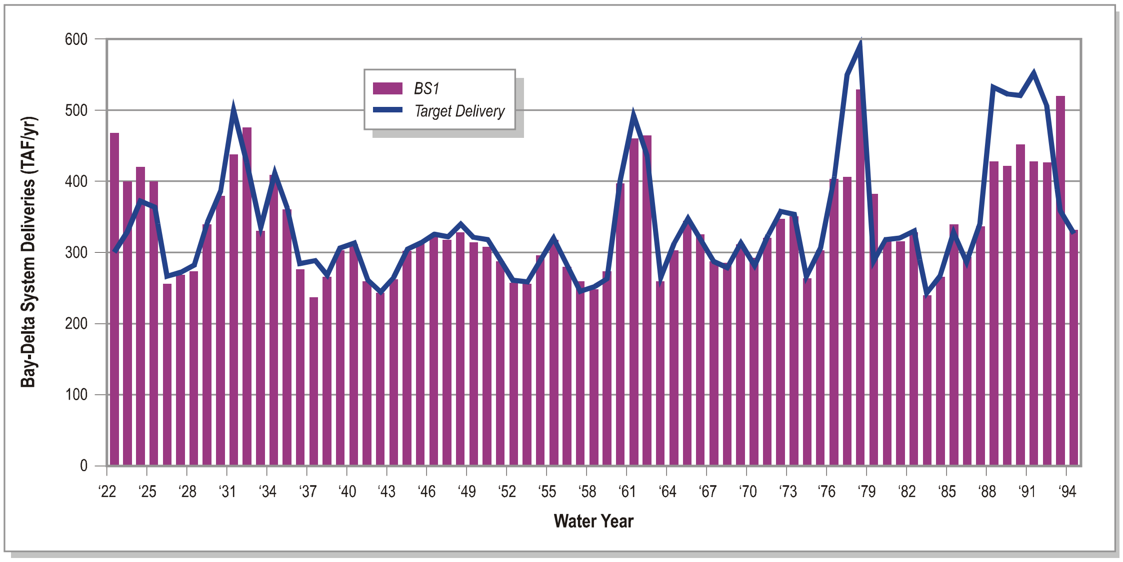

Figure 4-6 *Target Bay-Delta system deliveries for the Bay Area urban region are met in most years.*

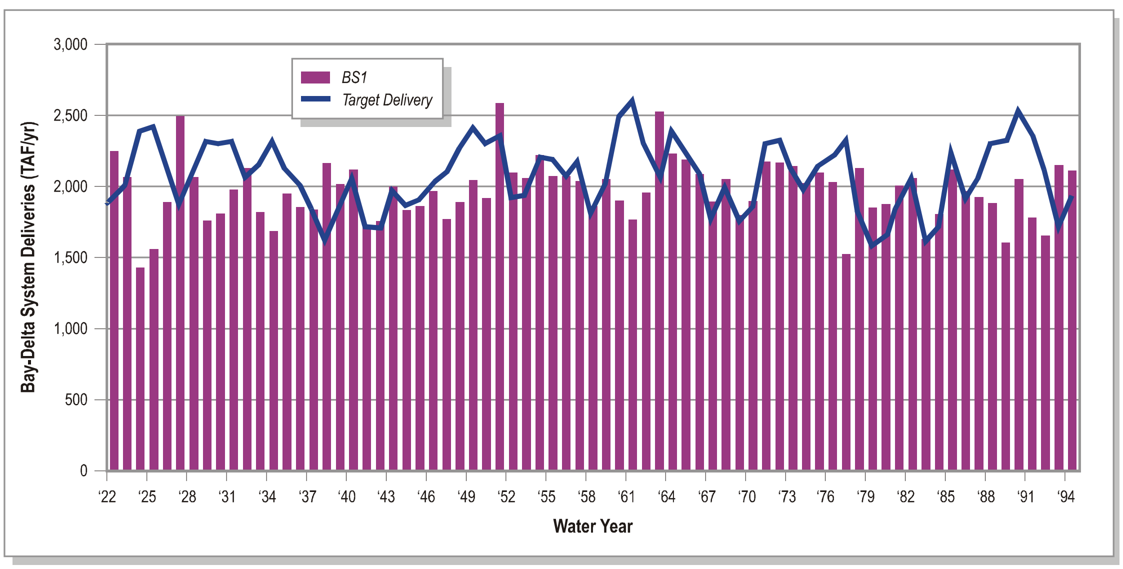

Figure 4-7 *Target Bay-Delta system deliveries for the South Coast urban region are not met in over 1/3 of the years modeled.*

Figure 4-8 displays the predicted composition of urban regional options and Bay-Delta supplies for four alternatives for the South Coast urban region. The most regional options are implemented for the BASE case and the least regional options are implemented for BS1. This result is expected because the BASE case provides the least Bay-Delta deliveries, and alternative BS1 provides the most. Desalting was not recommended as a cost effective regional investment for any of the example alternatives analyzed.

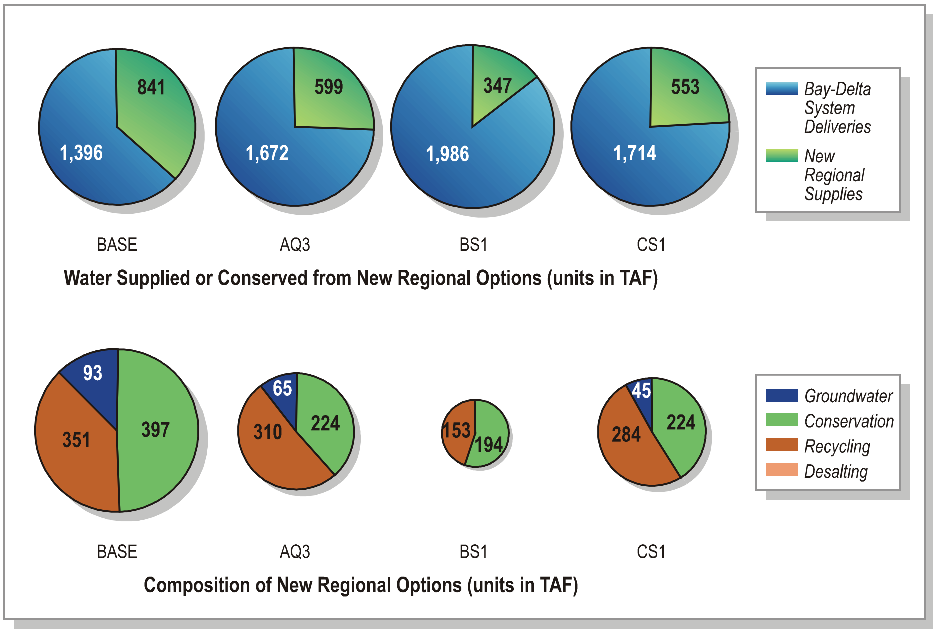

Figure 4-8 *Relative proportions of regional options implemented.*

Evaluating how successfully target deliveries for the urban regions are met requires adding project deliveries, interruptible water supplies, and transfers along with additional deliveries and/or demand reductions from regional options implemented. Table 4-4 compares expected deliveries from all modeled sources against the target deliveries for the South Coast urban region under hydrologic conditions like those of 1934 (a drought year). Under each of the alternatives shown, there is a gap between the water delivered and the target deliveries. This gap indicates that the regional economy is incurring some shortage costs. The costs incurred due to this mismatch over the entire simulation period are lower than the costs to supply the water in the urban economic model, otherwise, more local options would be implemented to eliminate the mismatch.

Table 4-4 ***Calculation of Demand Not Supplied in South Coast in Simulated Year 1934***				
	BASE (TAF)	AQ3 (TAF)	BS1 (TAF)	CS1 (TAF)
Project Deliveries	878	1,122	1,707	1,181
Interruptible Water Supply Deliveries	0	0	0	0
Transfers Received	0	468	584	210
Regional Options Implemented	841	599	347	553
Modeled Deliveries	1,719	1,721	2,044	1,734
Target Deliveries (based on demand)	2,330	2,330	2,330	2,330
Demand Not Supplied	**611**	**609**	**286**	**596**

Figures 4-9 and 4-10 show the annual exceedance frequency of shortage (mismatch between simulated deliveries and target deliveries) for the South Coast and Bay Area regions under the BASE and example alternatives. These exceedance curves represent the likelihood that deliveries will be less than target deliveries by a specific amount. For example, in Figure 4-9, the deliveries to the South Coast under AQ3 are at least 300 TAF / Year less than the target delivery in 80% of the years. These figures show that alternative BS1 provides the most reliable Bay-Delta deliveries in both the Bay Area and the South Coast.

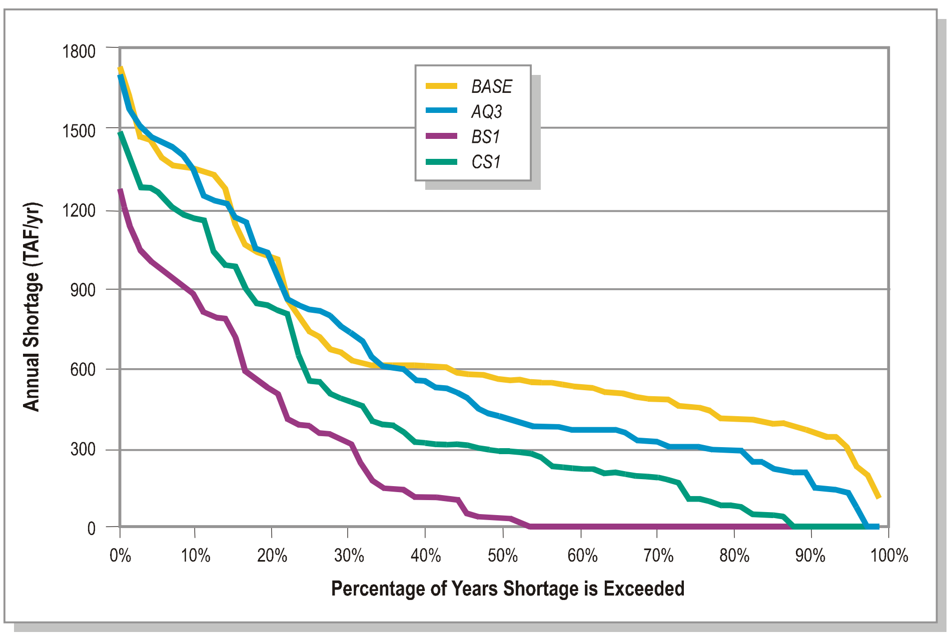

Figure 4-9 *In the South Coast urban region, not all demand is supplied in approximately 25% of years modeled.*

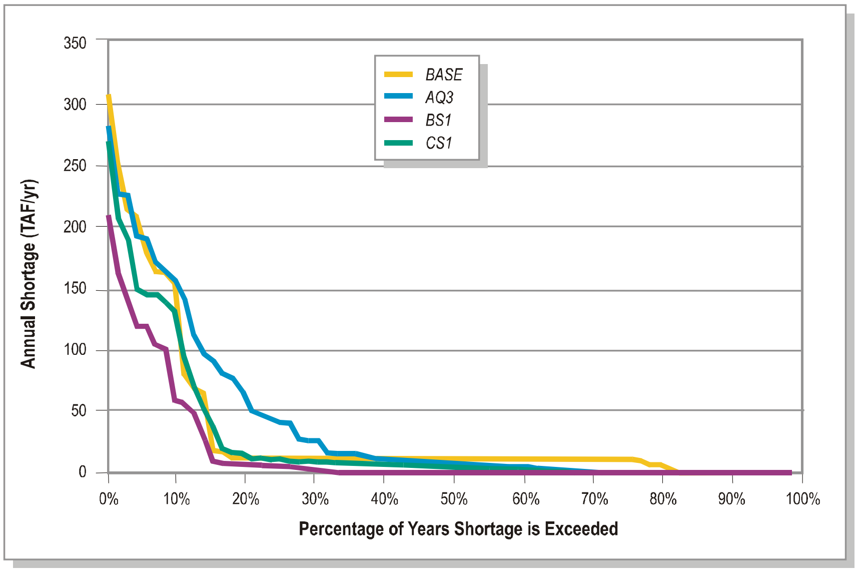

Figure 4-10 *In the Bay Area, not all demand is supplied.*

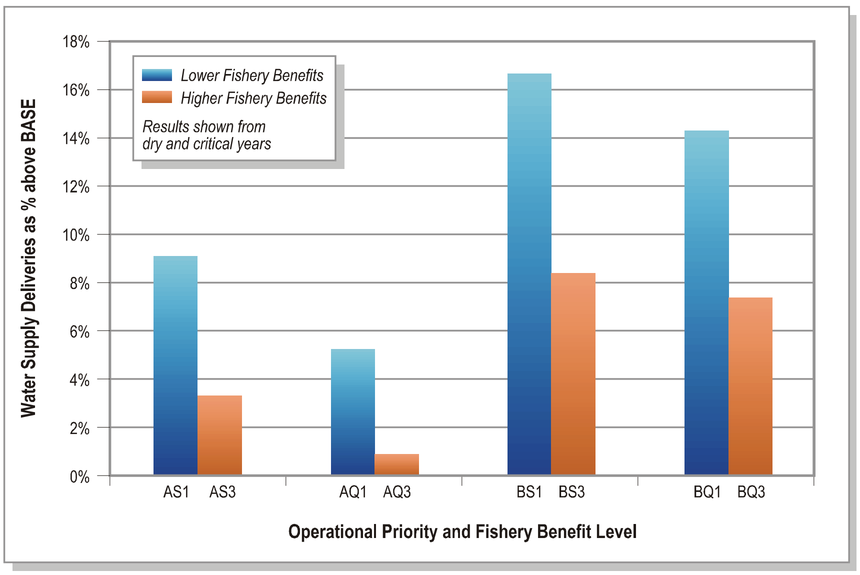

Figure 4-11 *As fishery benefits increase, deliveries decrease.*

4.2.3 Environmental Deliveries

Environmental deliveries to meet instream flow and Delta outflow requirements are an assumption underlying all example alternatives. As noted previously, the fishery benefit levels are designed to represent the frequency and duration of days that Delta pumping is curtailed to benefit fish passage. Alternatives with fishery benefits set to Level 1 curtailed Delta export pumping for an average of 28 days per year, whereas those incorporating fishery benefits at Level 3 curtailed Delta pumping for average of 76 days per year. Figure 4-11 illustrates the reductions to water supply deliveries for Resource Mix A and B due to increases in fishery benefits. Whether operated to emphasize water supply or Delta water quality, both resource mixes produce smaller increases to water supply deliveries under fishery benefit Level 3.

4.2.4 Tradeoffs

Figure 4-12 allows a direct comparison of relative performance for two different objectives: Delta water quality and water supply deliveries during dry and critical years. Plotting changes for several example alternatives (relative to the BASE) with water supply deliveries on the horizontal axis and Delta salinity on the vertical axis permits easy comparisons of tradeoffs. Note that all resource mixes (A, B, and C), operated to emphasize water quality improvements, provide both increased water supply deliveries and lowered salinity in the Delta as compared to the BASE. BQ1 and CQ1 provide more water supply deliveries, and AQ1 provides slightly better water quality than other example alternatives.

Beyond comparing relative performance of different resource mixes, the interaction between fishery benefit levels, water supply deliveries, and Delta water quality can be explored by comparing alternatives with different fishery benefit levels. For example, results from Resource Mix B, operated to emphasize Delta water quality, are shown for fisheries benefit Level 1 and Level 3 (BQ1 and BQ3). BQ1 provides about a 14% improvement in water supply deliveries (as compared to BASE) and a 22% reduction in Delta salinity. If the same resource mix is operated for the same water quality objective, but incorporates the more aggressive fishery benefit level (BQ3), the water supply deliveries are reduced to around 7% above the BASE with an 8% reduction in Delta salinity compared to BASE. The reduction in benefits for supply and quality are a tradeoff for allocating water to provide higher levels of fishery protection.

Studying changes in predicted performance in this manner can help better understand the relationships between changing water management actions. The results shown in Figure 4-12 reveal an unexpected tradeoff between fishery benefits and water quality. Conventional thinking holds that reduced Delta exports generally produce lower salinity values in the Delta; water quality is expected to improve as fishery benefit levels increase. The results, however, show the opposite trend. The additional pumping restrictions modeled in AQ3, BQ3, and CQ3 do result in less Delta exports, but water quality degrades instead of improving relative to AQ1, BQ1, and CQ1.

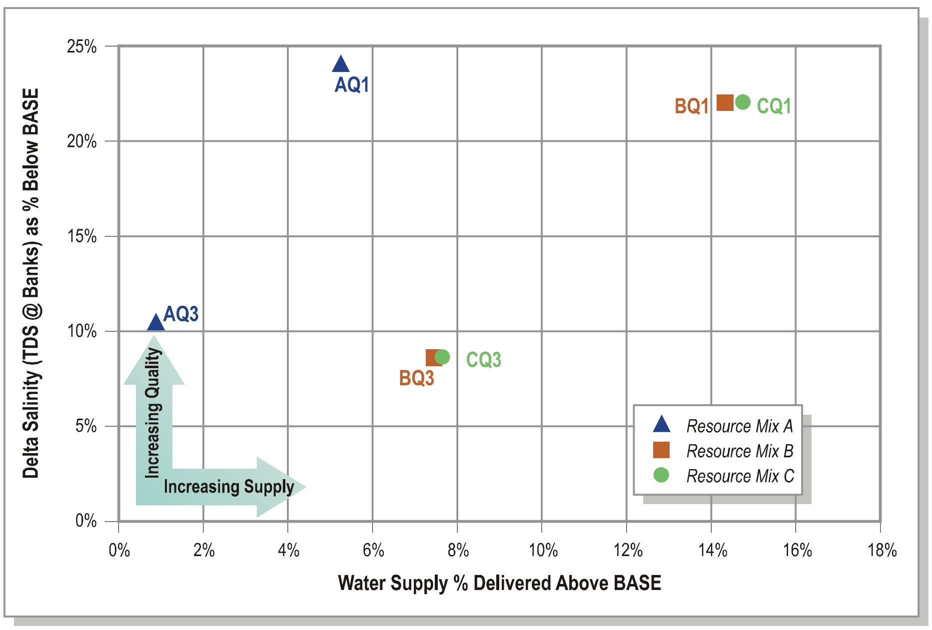

Figure 4-12 *More storage and export capacity provide more balanced performance for supply, quality, and fishery protection*

This counterintuitive finding related to Delta exports and Delta water quality was supported after considerable scrutiny of the comprehensive analysis model results. It appears that while the quantity of water being exported is lower under fishery benefit Level 3, changes in pumping patterns (quantity and timing) have a larger influence on salinity levels in the Delta than the annual quantity of water pumped. Figure 4-13 contains the average monthly salinity at Banks pumping plant and average monthly export quantities under AQ1 and AQ3. Note that monthly exports are lower for AQ3 than AQ1 during December - January, and March - June, due to the pumping curtailments for fishery benefits. However, monthly export quantities are generally higher for AQ3 than AQ1 during August - November. Typically, August - November is when Delta salinities are highest, and increasing Delta exports during these months in AQ3 seems to cause salinity concentrations to increase even further. As a result, even though annual export quantities are smaller under AQ3 than AQ1, the associated water salinity is higher.

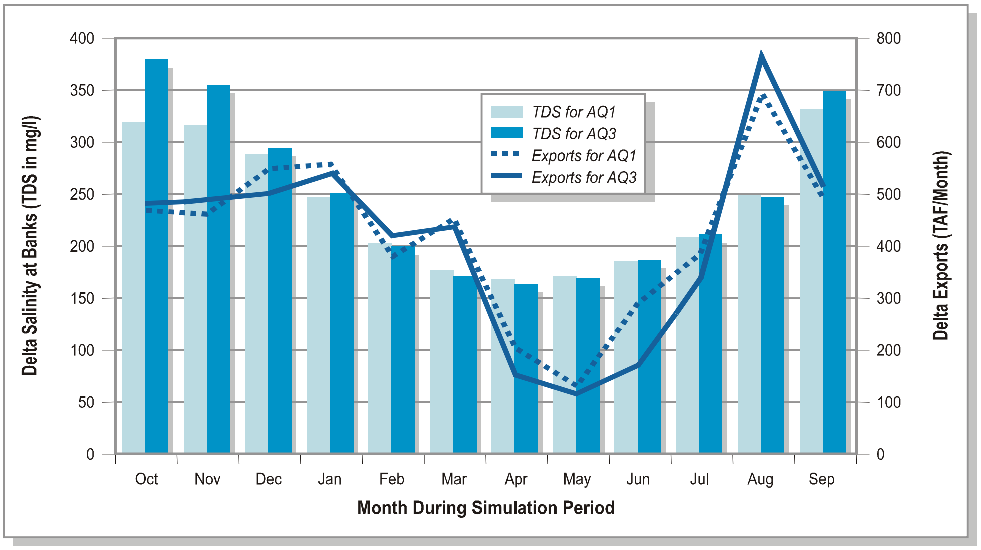

Figure 4-13 *Increasing fishery benefits results in less Delta water quality benefits in Delta exports because more water is pumped in higher salinity months.*

The WMS Evaluation Framework uses QWEST as one indicator of environmental benefits. QWEST is a broad indication of the net direction and quantity of flow through the combination of channels that carry water from the Central Delta towards the San Francisco Bay. Generally, a positive QWEST is desirable for Delta flow circulation, water quality, and fisheries. Figure 4-14 shows long-term average annual tradeoffs among the environmental, agricultural, and urban sectors. All three alternatives presented show improvement for the three performance measures as compared to the BASE case. AQ3 provides the largest improvement to QWEST and BS1 and CS1 provide the largest increases in water supply deliveries.

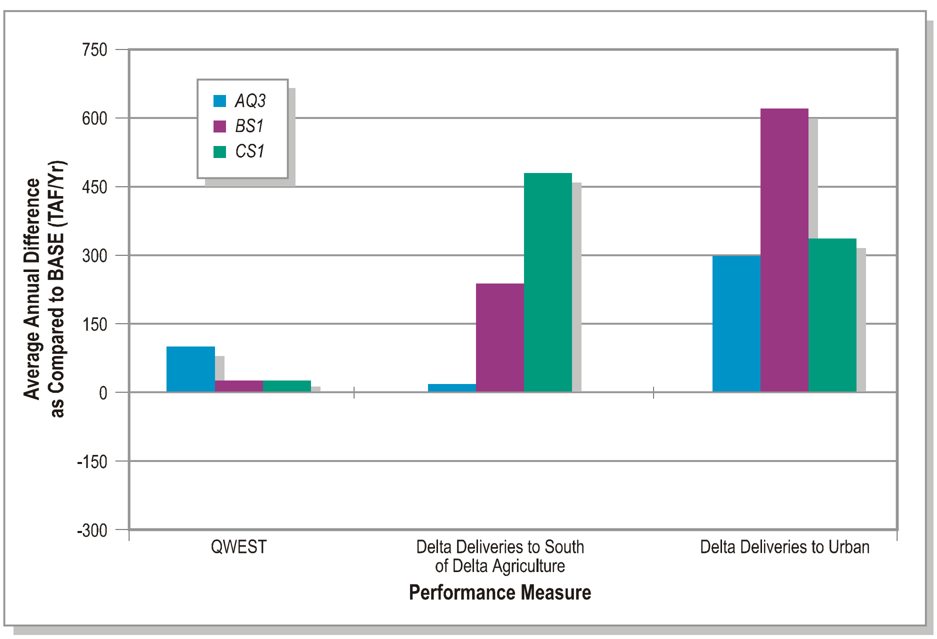

Figure 4-14 *Each alternative provides benefits to different sectors.*

4.3 Resource Contributions

It is possible to examine the analysis results to determine how various options contribute to the water supply. The paragraphs below refer to Figure 4-15, which shows the contributions to surface water supply from increasing groundwater storage, relaxing Delta export limits, and increasing surface water storage. These contributions may be considered “facility benefits.”

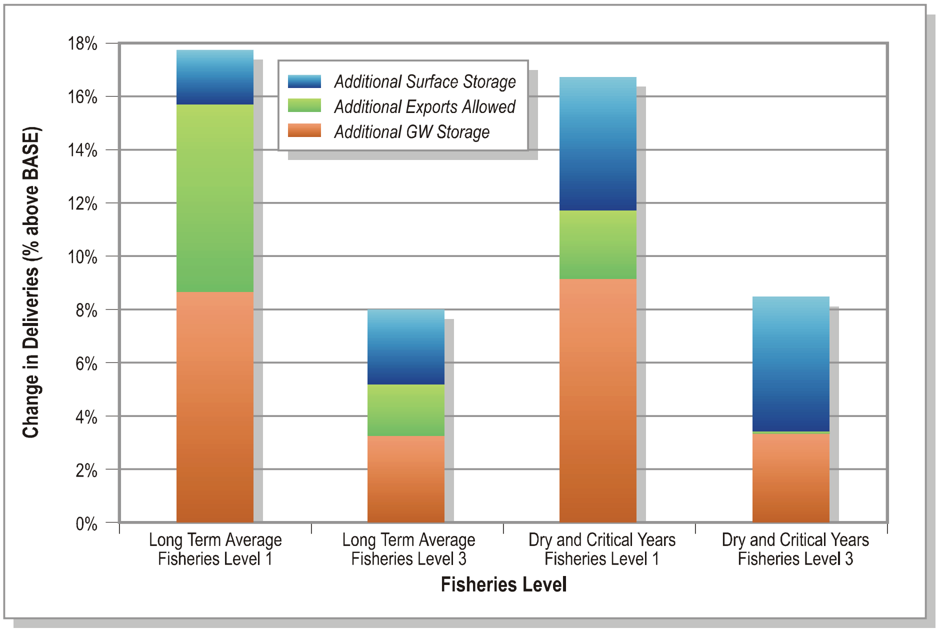

Figure 4-15 *Relative contributions from different water management actions.*

The differences in Bay-Delta deliveries between resource mixes can be attributed to the effects of adding the water management actions in each resource mix. Resource Mix A has higher deliveries than the BASE case primarily because of increased groundwater storage. Resource Mix B includes the groundwater storage of Resource Mix A, increased north of Delta surface water storage, and increased Delta exports. Because Resource Mix B was modeled both with and without increased surface water storage, the effects of relaxing Delta export limits from 1995 levels and of increased surface water storage can be evaluated separately.

Conjunctive use can be an important component for increasing the available water supply. At fisheries benefit level 1, increasing groundwater storage accounts for an 8 percent increase in Bay-Delta deliveries both on average and in dry and critical years. This represents more approximately 50 percent of the water supply improvement relative to the BASE case. However, the groundwater storage contribution of the water supply improvement drops to 3 percent when Delta exports are curtailed to provide higher fisheries benefits.

Allowing increased Delta export limits above 1995 levels has a significant effect on the available supply during normal and wet years, as long as pumping curtailments do not reduce exports. Relaxing the export limit results in an increase in deliveries of 7 percent above the BASE case at fisheries benefit level 1, compared to only 2 percent at fisheries benefit level 3.

Adding new surface storage north of the Delta accounts for a significant portion of the increased water supply provided to south-of-Delta users during dry and critical years. Surface water storage accounts for about 5 percent of the increase regardless of the amount of pumping curtailments that are intended to provide fisheries benefits.

The benefits of increased surface storage are most evident when the water management system is most stressed. During dry and critical years, surface water storage accounts for 5 percent of the 8 percent increase in Bay-Delta deliveries at fisheries benefit level 3. This finding suggests that surface water storage can provide the increased system flexibility needed to improve water supply deliveries and provide additional protection for fisheries during dry years.

4.4 Transfers

Voluntary transfers of water between willing participants can play an important role in meeting the water needs of the state. The example alternatives analyzed for this study included limits on the quantity of water that could be transferred from particular regions. Transfers are initiated in the models when expected deliveries for a given period drop below a set threshold. As expected, the greatest quantity of transfers occurs during dry and critical years. Table 4-5 lists the water transfer amounts for the WMS action alternatives.

The transfer results are presented graphically in Figures 4-16 and 4-17 for alternatives AQ1 and AQ3, respectively. These figures show overall transfer patterns and illustrate changes due to various fishery benefit scenarios. When reviewing these results, it should be noted that while the analysis allows water to be transferred from north of Delta (NOD) agriculture to south of Delta (SOD) agriculture, the transfer almost never occurs because urban users take the majority of the NOD water available for transfer. The volumes transferred shown in Figure 4-17 represent the largest transfer volumes observed for the example alternatives.

Table 4-5
Water Transfers in Dry and Critical Years (TAF)*

		AS3	***BS1***	***CS1***
NOD Transfers	Total water transferred from NOD	62	93	46
	Water received by Bay Area	2	4	2
	Water received by Central & South Coast	22	42	20
	Water received by SOD agriculture	0	0	0
	Water transfer outflow to ocean	38	46	24
SOD Transfers	Water transferred by San Joaquin	156	70	45
	Water transferred by Tulare	172	72	55
	Water received by Bay Area	26	10	9
	Water received by Central & South Coast	301	133	91

*Note: The total volume of water transferred is rounded to the nearest integer and in some cases may not sum to the total presented.

As fishery benefits increase, Delta deliveries decrease, which increases the demand for transfers. To respond to reduction in pumping, NOD transfers increase, but much of this water cannot get through the Delta because of pumping restrictions. Figures 4-16

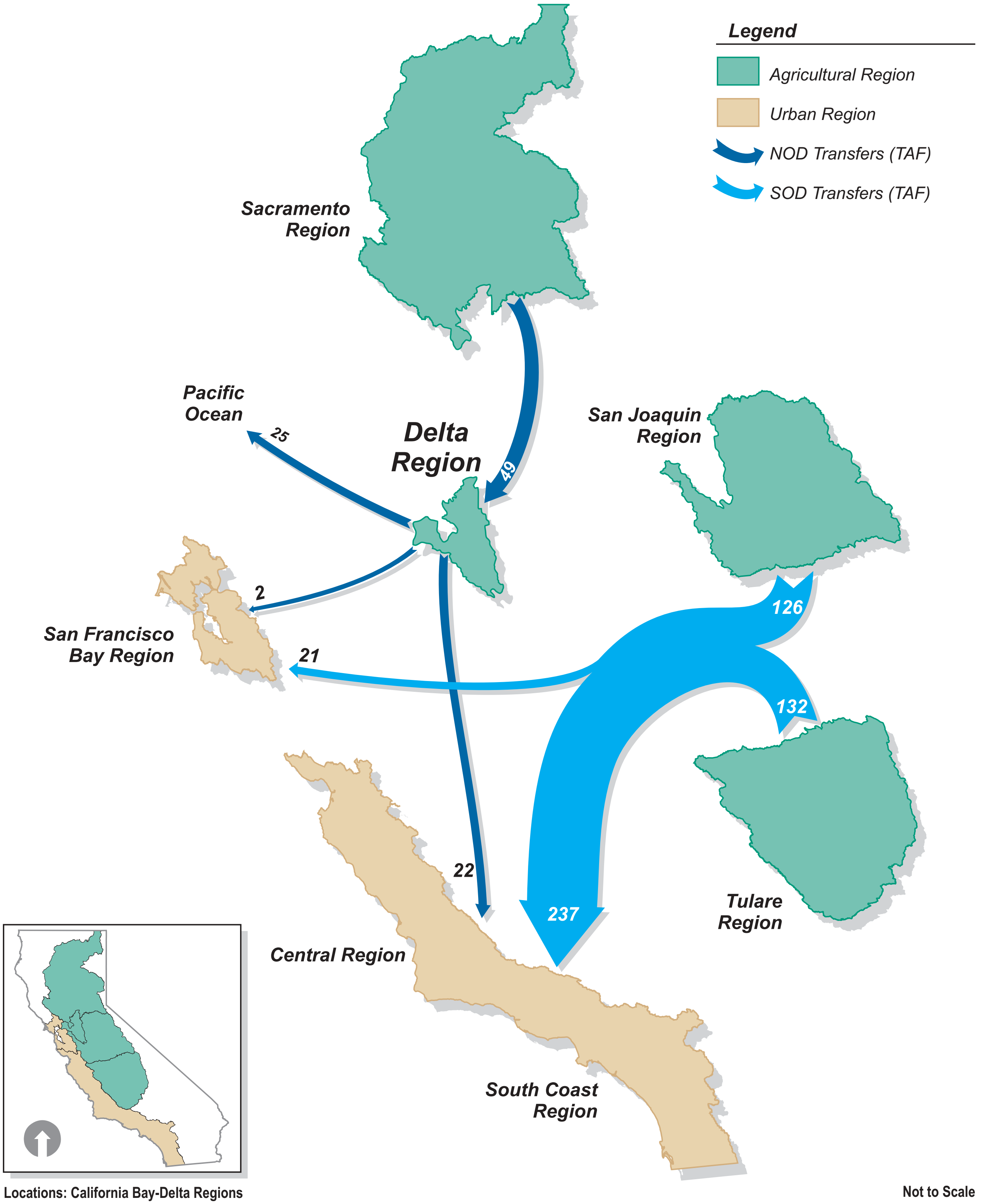

Figure 4-16
Bay-Delta Water System:
Dry and Critical Year Water Transfers Under Alternative AQ1
Evaluating and Comparing Proposed Water Management Actions

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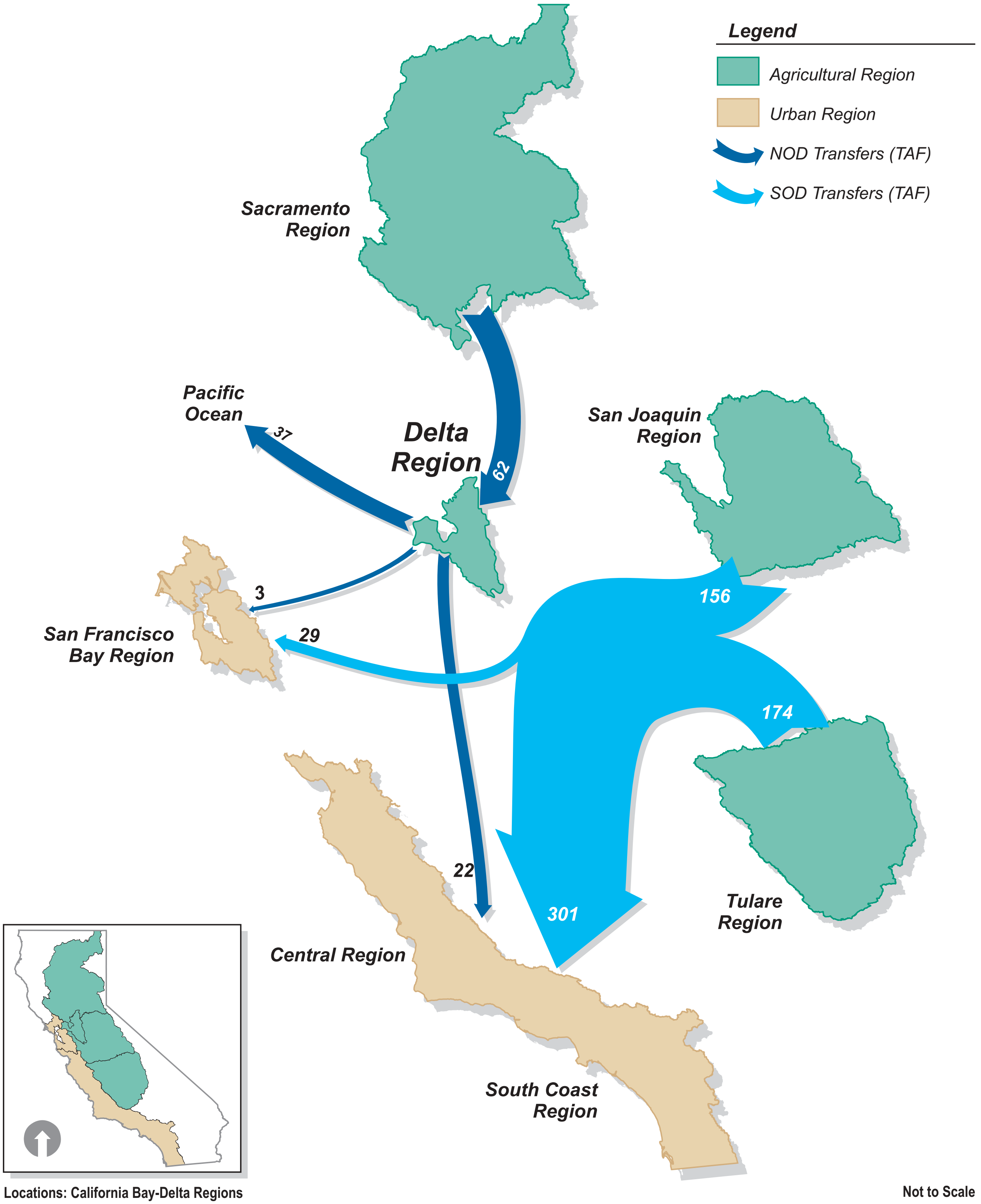

Figure 4-17
Bay-Delta Water System: Dry and Critical Year Water Transfers Under Alternative AQ3
Evaluating and Comparing Proposed Water Management Actions

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and 4-17 illustrate that NOD transfers are increased from the Sacramento Region when higher levels of fishery benefits are sought, but more water is lost to the ocean, and approximately the same amount is received by SOD users as with lower fishery benefit levels. Increased demand for transfer water is not met through NOD transfers, thereby increasing demand for SOD transfers. Figures 4-16 and 4-17 also show that SOD transfers increase significantly as fishery benefits increase.

The analysis assumes that NOD transfers would be less expensive than SOD transfers. However, not all water purchased in the NOD transfers is received by SOD buyers, because a portion of the water must go to the ocean as it travels through the Delta. For this analysis, the unit price for all water transferred from a particular region is set to be equal to the marginal value to the seller of the last unit of water transferred from that region. Given the small-market nature of water transfers, transaction costs are expected to influence the price. The method used to estimate the annual transfer price may not fully capture the effects of transaction costs, but seemed the most reasonable approach given the available data.

4.4.1 Transfer Efficiency

Table 4-6 presents the projected costs to the purchaser for transfers from the originating regions, taking into account the transfer losses. Each acre-foot of Sacramento region transfer received by a purchaser can be effectively more expensive than other regions' transfers, because the entire amount of water purchased does not always get delivered through the pumps. The amount of transferred water that goes to the ocean may be used to estimate the efficiency of transfers from various regions. In dry and critical years, transfers from the San Joaquin region are less expensive than the Sacramento region in some alternatives. Transfers from the San Joaquin region are less expensive in all alternatives for the long-term average.

It is assumed that agricultural users would transfer their water before it is delivered, so instead of being delivered to the agricultural region, it will go directly to the urban purchaser. The conveyance losses associated with the agricultural and urban distribution systems are approximately equal, so the efficiency for SOD transfers is assumed to be 100%.

The transfer model also assumes that transfers from NOD will occur first because they are less expensive. When costs are compared by amount of water received (Table 4-6) rather than by the amount transferred, however, there can be some instances when water from some SOD regions could be slightly less expensive. Future analysis would benefit from a more dynamic representation of transfer activities based on economic response.

Table 4-6
Transfer Cost by Transferring Regions in Dry and Critical Years

Alternative	*Amount transferred (TAF)*	*Cost ($/AF transferred)*	*Amount received (TAF)*	*Transfer Efficiency*	*Cost of water received ($/AF received)*
Sacramento Region					
AQ3	62	56	25	40%	**139**
BS1	93	82	46	50%	**166**
CS1	46	60	22	47%	**100**
San Joaquin Region					
AQ3	156	133	156	100%	**133**
BS1	70	232	70	100%	**232**
CS1	45	147	45	100%	**147**
Tulare Region					
AQ3	172	199	172	100%	**199**
BS1	72	317	72	100%	**317**
CS1	55	268	55	100%	**268**

4.4.2 Sellers' Point of View

Model assumptions about water transfers are based on historic data. During dry years, the higher price of water in the water market induces farmers to transfer water rather than use it to grow crops. For example, in Alternative AQ3, the marginal value of San Joaquin water is $42 an acre-foot in average years and $133/af in dry years. In dry years, farmers profit more by transferring the delivered water than by using the water for crop production. Although the transfer of water out of the region leads to fewer supplies to meet target deliveries, the region obtains economic benefits from the water transfers.

The upper limits for water transfers for example alternatives are based on the preferences of CALFED agencies and stakeholders. These groups were concerned that allowing water to be transferred out of agricultural regions would cause economic hardship in those regions. The example alternatives, therefore, include different upper limits of water transfers according to the preferred levels that agencies and stakeholders specified while developing each alternative. In testing the comprehensive analysis approach, an important finding resulted from examining the economic effects of water transfers in agricultural regions. Limiting water transfers out of

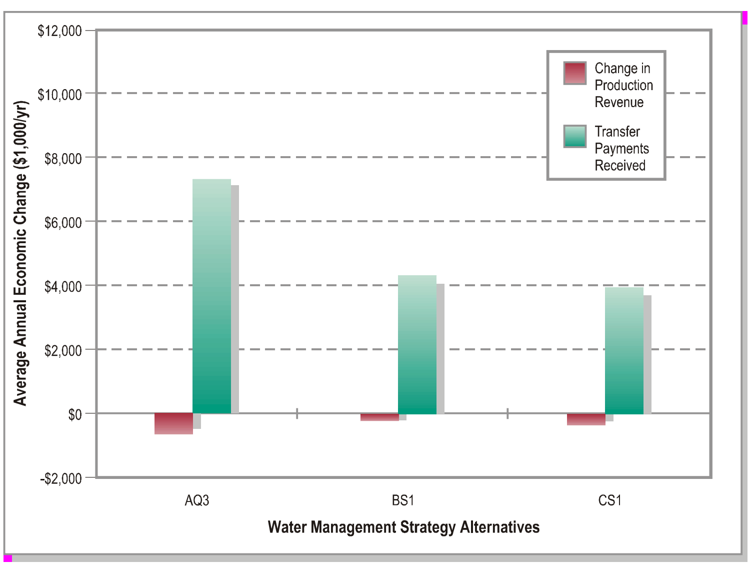

Figure 4-18 *Transfer payments exceed the loss in production revenue in the San Joaquin region.*

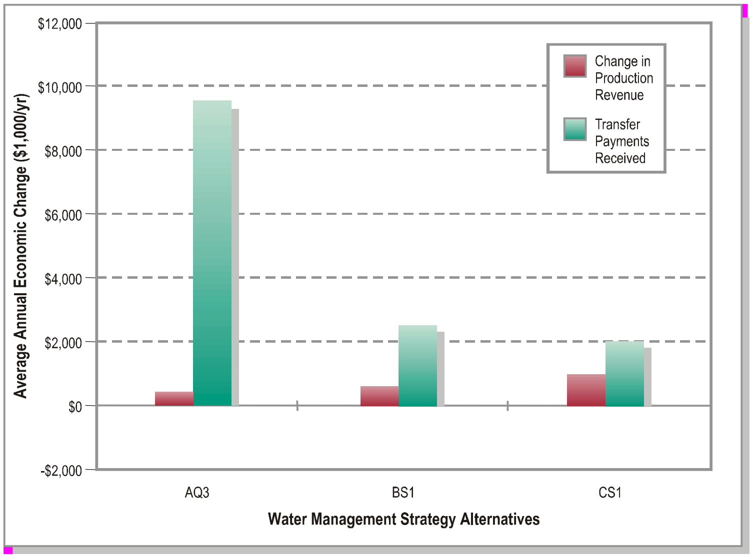

Figure 4-19 *Transfer payments add to the increase in production revenue in the Tulare region.*

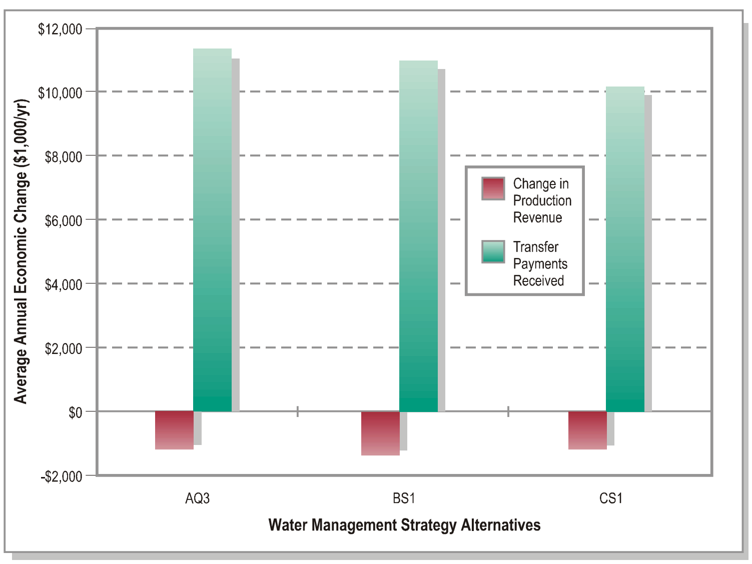

Figure 4-20 *Transfer payments exceed the loss in production revenue in the Sacramento region.*

agricultural regions may be limiting substantial economic gains.

Figures 4-18 through 4-20 show the average annual transfer payment received and change in production revenue relative to the BASE case (incorporated as zero in the referenced figures) for several example alternatives in the San Joaquin, Tulare and Sacramento regions, respectively. These analyses assume that the price of the transfer water equals the marginal value of the last unit of water transferred from the region. The production revenue is the economic change in response to increased project deliveries and interruptible supplies less the water voluntarily transferred out of the region.

The transfer revenues in all three regions under Alternative CS1 are less than in Alternatives AQ3 and BS1 because the model allows fewer transfers in CS1 than in AQ3 or BS1. The Tulare region receives a large interruptible water supply and therefore has a net increase in production revenue relative to the BASE in spite of the transfers. On the other hand, the San Joaquin and Sacramento regions receive few additional project deliveries over the BASE case and no interruptible water supply. Consequently, the change in production revenue is caused primarily by water being transferred out of the region. The San Joaquin and Sacramento economic data show that the benefit of transfers for the agricultural regions is much larger than the loss in production revenue caused by transferring the water. For example, for alternative CS1 in the San Joaquin region (Figure 4-18), the transfer benefits gained reach almost $4 million per year while the production revenue lost is under $500,000 per year.

The shift in revenue from production to transferring water out of the region would likely cause secondary effects in the economics of associated sectors, some positive and some negative. Further analysis is required to quantify those impacts.

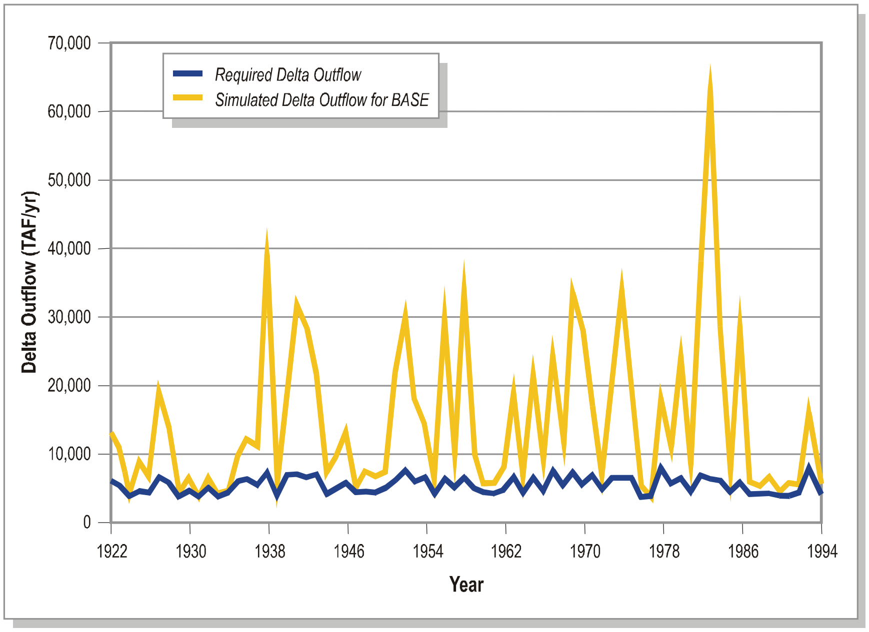

***Figure 4-21** In many years, Delta outflow exceeds the amount necessary for protection of water quality and ecological benefits.*

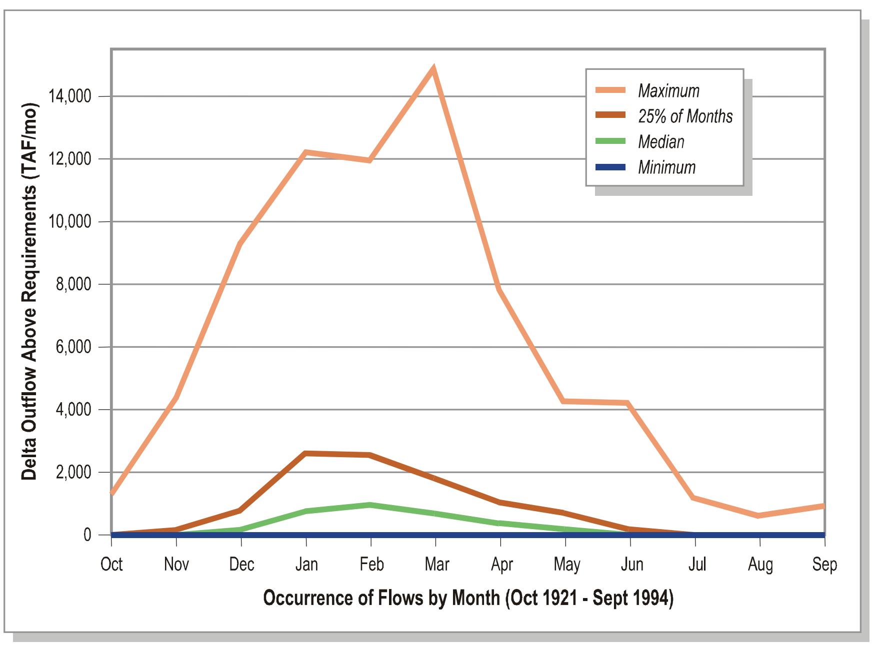

***Figure 4-22** Surplus Delta outflows are available in most years during the winter months. The "25% of Months" line shows, for example, that in 25% of Januaries modeled, at least 2,500 TAF is available.*

4.5 Availability

The resource mixes all include new storage in the form of groundwater or surface storage. For new storage to be effective, there must be water available in the system that could be captured for managed use. Figure 4-21 shows annual Delta outflows under the BASE case in comparison to the required Delta outflows established to protect water quality and ecological health in the Delta. Outflows exceed the requirements in most years, with large annual variations in total Delta outflow. During most wet years, Delta outflow peaks at around 32 MAF annually, whereas during most dry years, Delta outflows are as low as 6 MAF annually. Required Delta outflow typically ranges from 3.7 MAF to 8.4 MAF a year.

When considering the availability of water that could be managed using additional storage, a probability characterization is sometimes more useful than annual time series. Figure 4-22 shows the same data as Figure 4-21, but arranged as monthly percentiles of Delta outflows that exceed the required Delta outflow. The data shown in Figure 4-22 show that in every month, there are some years that Delta outflow does not exceed the requirements, but for 50% of the years, at least 700 TAF of outflows above Delta requirements occur during January through March. This figure demonstrates that Delta outflow frequently exceeds the minimum requirements by a substantial amount. The benefits generated by the additional storage in the example alternatives presented in this report stem from capturing a small fraction of the outflows above the requirements. As seen in some of the alternatives, this additional stored water can be managed to provide ecosystem benefits during dry and critical years.

4.6 Economic Considerations

Another important consideration when evaluating alternative water management strategies is the economic implications of each alternative. Policy makers and stakeholders typically want to know the likely economic impacts of a proposal along with other indications of performance, such as increased deliveries or improvements to water quality. The benefits are typically weighed against the costs when evaluating the merits of a proposed water management action. The comprehensive modeling approach used in this report can help predict many of the relevant economic costs and benefits. The modeled economic costs and benefits are most useful to predict relative differences in performance by comparing results from different alternatives modeled with consistent methods and tools.

Tables 4-7 and 4-8 contain examples of the economic information and associated water transfer activities modeled for these example alternatives. The tables are divided into two sections: economic costs and benefits, and transfer payments. (In this context, the transfer payments do not represent a net economic benefit to society, but rather a transfer of money from one sector to another between willing buyers and willing sellers.)

The economic costs shown in Table 4-7 for Alternative BS1 include two elements. First, the estimated annual cost of building, operating and maintaining the facilities proposed for Alternative BS1 is $192.2 million per year. The second portion of the economic costs stem from a prediction of reduced agricultural production under Alternative BS1 as compared to the BASE case. This reduction is predicted to cause an average annual reduction in agricultural net production revenue of $900,000 per year.

The economic benefits in Table 4-7 also consist of two elements: reduced investment in regional options for urban water supply, and reduced costs of shortage for urban water supply. The reduction in urban regional option costs of $313.1 million dollars per year indicates that the urban regions invest less in regional options to meet their demand under alternative BS1 than under the BASE case. The lower regional investment is seen as an economic benefit, presuming that the urban region would share in the cost to build and operate the new facilities under alternative BS1. The other economic benefit shown is the reduction in economic costs faced by the urban water users caused by demand not supplied ($40.3 million per year).

Table 4-7: Economic Changes for Water Management Strategy Alternative BS1 as Compared to the BASE Case (Million Dollars per Year[2])

Economic Costs and Benefits	Costs	Benefits
Annual Capital and O&M Cost to Implement Alternative	192.2	
Change in Agricultural Net Production Revenue	0.9	
Reduction in Urban Regional Option Costs		313.1
Reduction in Urban Shortage Costs		40.3
Total Economic Change	193.1	353.4
Transfer Payments	**Paid**	**Received**
Receipts to Agriculture for Release of Transfer Water		21.3
Payments to Acquire Transfer Water for ERP	14.5	
Payments to Acquire Transfer Water for Urban Use	6.8	
Total Transfer Payments	21.3	21.3
Annual Net Economic Benefit		**160.3**

These numbers represent economic costs and benefits that were modeled explicitly. The economic results do not predict the economic value of changes related to environmental benefit, recreation, flood control, or other possible economic impacts. While recognizing that there is economic value associated with potential impacts other than agricultural production and urban water supply, explicit modeling of these factors were beyond the scope of this analysis. Furthermore, predictions of economic change due to agricultural production and urban water supply are thought to represent the majority of economic impacts associated with the types of alternative water management strategies considered in this study.

Understanding that the economic information shown in Table 4-7 does not fully capture likely economic impacts, the results are still promising for Alternative BS1. The modeled economic benefits exceed the economic costs to produce a net benefit of $160.3 million per year. This finding suggests that Alternative BS1 is economically viable. In other words, sufficient economic benefits are expected to result from the investments required to implement Alternative BS1 that the collective beneficiaries should be willing and able to pay for the investments.

Table 4-8 shows a similar result. The net benefit is smaller, but still sufficient ($31.3 million per year) to make Alternative CS1 economically viable as a package. In fact, most of the alternatives analyzed for this study were economically viable even without considering the economic value of environmental, recreation, hydropower, or other benefits. The alternatives that do not produce a net economic benefit without explicitly considering environmental and other benefits are those that use Resource Mix C and Fisheries Benefit Level 3 (CQ3, CS3).

[2] Reported as 2001 dollars

This finding suggests that while substantial investments are required to implement some of the alternatives, most of the example water management strategy alternatives evaluated are potentially economically feasible approaches to improving the conditions of the water management system in California. The determination of economic feasibility applies to the packages of water management actions collectively, and does not address the economic viability of individual water management actions considered separately.

Table 4-8: Economic Changes for Water Management Strategy Alternative CS1 as Compared to the BASE Case (Million Dollars per Year)

Economic Costs and Benefits	**Costs**	**Benefits**
Annual Capital and O&M Cost to Implement Alternative	184.2	
Change in Agricultural Net Production Revenue	0.6	
Reduction in Urban Regional Option Costs		207.9
Reduction in Urban Shortage Costs		8.2
Total Economic Change	184.8	216.1
Transfer Payments	**Paid**	**Received**
Receipts to Agriculture for Release of Transfer Water		16.0
Payments to Acquire Transfer Water for ERP	12.4	
Payments to Acquire Transfer Water for Urban Use	3.6	
Total Transfer Payments	16.0	16.0
Annual Net Economic Benefit		**31.3**

These economic results also do not address specifically how the economic benefits would be allocated among different beneficiaries, or how the costs would be shared. A more detailed analysis of cost and benefit allocation will need to be done as water management strategy analyses become more refined and the CALFED program approaches decision points regarding the implementation of specific water management actions.

The economic costs and benefits in Tables 4-7 and 4-8 also do not include predictions of third-party impacts related to economic changes from the proposed water management strategies. Third-party impacts were modeled for reductions in agricultural revenue (using IMPLAN) but are not presented in these tables. Models are not currently available to predict third-party impacts related to changes in urban economics. Therefore, while IMPLAN predicts the negative impacts, there currently is no model to predict the positive effects of increasing benefits in urban areas, or to consider the possible benefits from increased transfer revenue in agricultural regions.

Again, the Transfer Payments section of Tables 4-7 and 4-8 do not reflect a change in the net economic benefit for different alternatives. Nonetheless, the transfer payments do reveal some interesting points. For instance, the model results predict that net revenue from agricultural production will be reduced by $900,000 per year under Alternative BS1 as compared to the BASE case. The modeled change in agricultural production reflects changes in water delivery from the Delta system as well as decisions to transfer water in dry years coupled with temporary land fallowing. The expected benefit to the agricultural sector making the voluntary transfers is predicted to be an additional $21.3 million dollars per year in transfer revenues. As a sector, the agricultural regions are giving up $900,000 per year in net production revenue and receiving $21.3 million per year as a result. Recognizing that transfers and transfer prices typically are reached through some form of negotiated settlement, there seems to be sufficient net benefit to the sector that policies could be developed to address any negative third-party impacts caused by the reduction in annual production revenue.

4.7 Comparing Alternatives within the WMS Evaluation Framework

This section provided some interesting examples of the types of data and comparisons that may be made using the results of the comprehensive analysis approach. These results are examples of the types of data that feed into the WMS Evaluation Framework, which compares alternatives' performance according to all of the CALFED objectives. As noted previously, stakeholders and decision makers consider a wide variety of indicators to be important when comparing alternatives, and may require several different sets of results before deciding which alternatives are "best." Cost, for example, is only one category of data that must be considered when comparing alternatives. Stakeholders participating in the development of the WMS Evaluation Framework included over 70 predictive performance measures for comparing the alternatives according to CALFED objectives. Viewing the performance of various alternatives according to the entire set of objectives would allow decision-makers to determine which combinations of actions meet multiple objectives most effectively. The comprehensive evaluation approach described in this report equips CALFED with data associated with many of the requested performance measures.

Section 5
Findings and Future Applications

The CALFED Water Management Strategy team has developed and tested the WMS Evaluation Framework using analytical tools capable of simulating the outcomes resulting from adoption of alternative strategies. Application of the Framework confirmed some conventional wisdom, revealed some unexpected effects, and helped identify where refinements could be most useful.

The evaluations reviewed in Section 4 illustrate how current analytical tools can be used to predict changes in water quantity, water quality, and economic performance for WMS alternatives. Examining the effects and tradeoffs associated with various water management strategies can provide insights that should help policy makers implement appropriate actions. This section highlights some of the insights revealed by results to date and explains current and planned tasks that will improve the data and analytical tools supporting the Evaluation Framework.

5.1 General Findings

The water management strategies described in this report provided illustrative examples of how evaluative tools can support decision-making. At the same time, the development team was able to identify some of the strengths and weaknesses of the water management system and likely effects of different proposed actions. Significant findings resulting from this initial effort are summarized below. Additional discussion regarding some of the tradeoffs among alternatives can be found in Section 4. Appendix B presents detailed results.

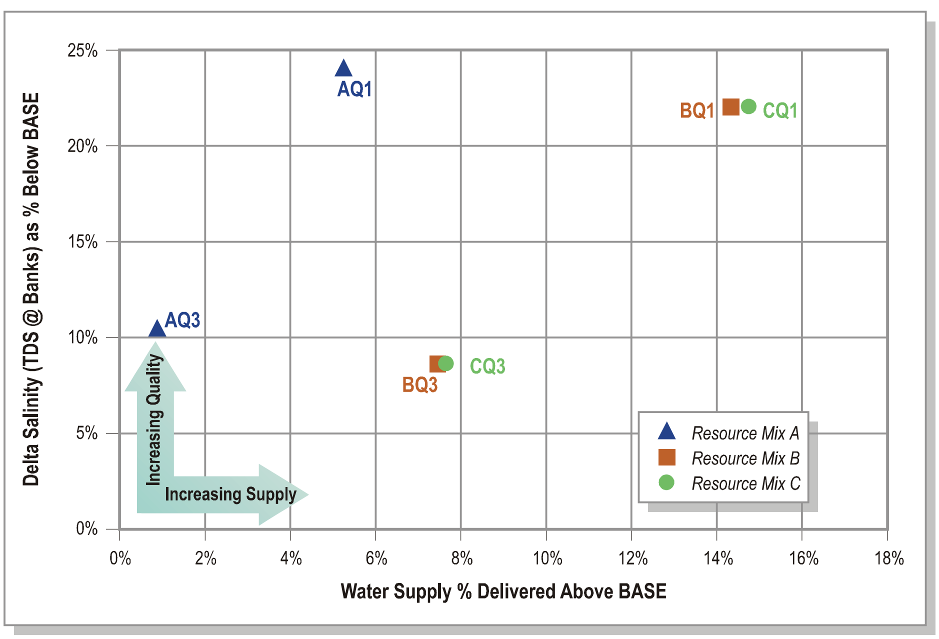

Figure 5-1 *Alternatives increase quality and supply over the BASE case*

1. All of the alternatives evaluated produce the following changes relative to the BASE case both during average and in dry and critical years:

   - Improved access to water supplies; and
   - Reduced salinity in the Delta.

   All of the alternatives studied result in increased deliveries and reduced salinity compared to the BASE case. This is true regardless of the assumed level of fisheries benefit. However, the magnitudes of each of these benefits vary by alternative, offering decision makers significant tradeoffs.

2. Some alternatives provide slightly more salinity reduction in the Delta than others. Alternatives that can provide the greatest salinity reduction within the Delta are those that restrict Delta exports to 1995 levels, while relying primarily on increased water use efficiency measures to address increased demands.

3. While all the alternatives that emphasize water quality successfully reduce average salinity in the Delta, alternatives designed with higher levels of fisheries benefits (e.g., AQ3, BQ3, or CQ3) appear to degrade water quality in the South Coast compared to those that provide only the base level of fisheries protection (e.g., AQ1, BQ1, or CQ1). This is because alternatives with increased fisheries benefits force Delta export pumping from the lower salinity spring months to the higher salinity late summer and winter months.

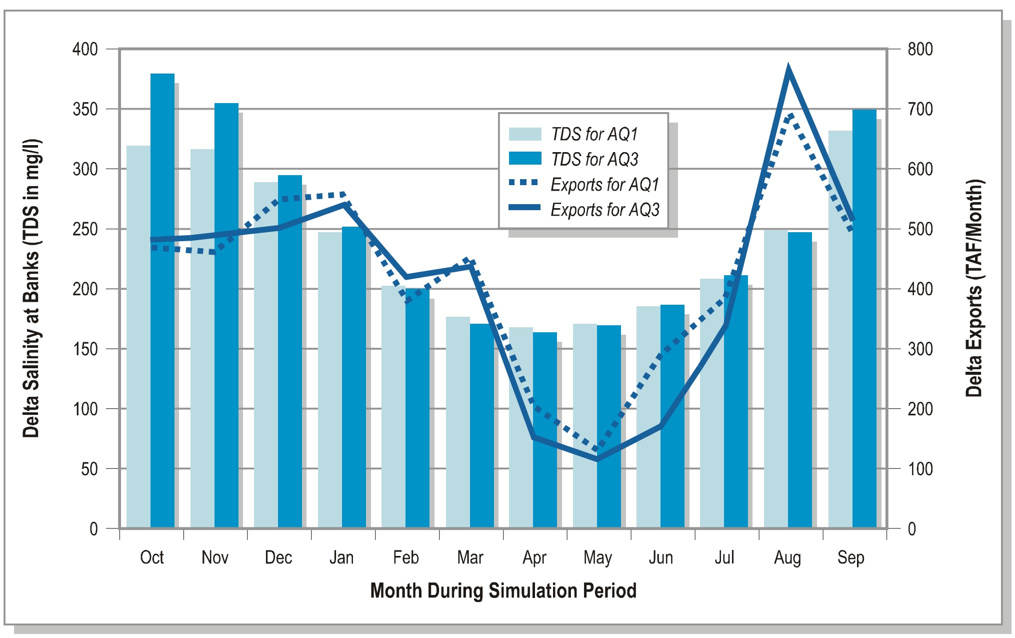

***Figure 5-2** Increasing fishery benefits results in less Delta water quality benefits*

4. Alternatives combining additional storage and increased exports from the Delta provide greater access to water supplies for south-of-Delta users. Resource Mixes B and C produce higher delivery levels than Resource Mix A at each of the fisheries benefit levels studied.

5. As Delta export restrictions increase, the overall water supply benefits from a resource mix decrease. That is, the improvement in water supply deliveries are smallest in those alternatives providing greater fishery benefits. Changes in Delta export patterns to improve fisheries could potentially make south-of-Delta users more vulnerable to reduced deliveries.

6. Importantly, the evaluation demonstrated that the level of benefits to water users resulting from investments in facilities is almost entirely dependent on the assumed levels of pumping curtailment needed to protect fisheries. That is, operational priorities have a greater impact on system performance than the investments in facilities identified as water management options. For example, while conjunctive use provides significant long-term water supply in dry and critical years, the contribution to meeting consumptive demands is significantly reduced as fishery benefits increase. Further, increasing Delta export limits above 1995 levels can provide increased water supply during normal and wet years, but these improvements are also limited by pumping restrictions and are reduced during dry and critical years as well. The possible exception to this relationship is surface storage. Surface storageis an investment that can provide additional deliveries under a variety of conditions, with the most significant contribution of benefits occurring during dry and critical years.

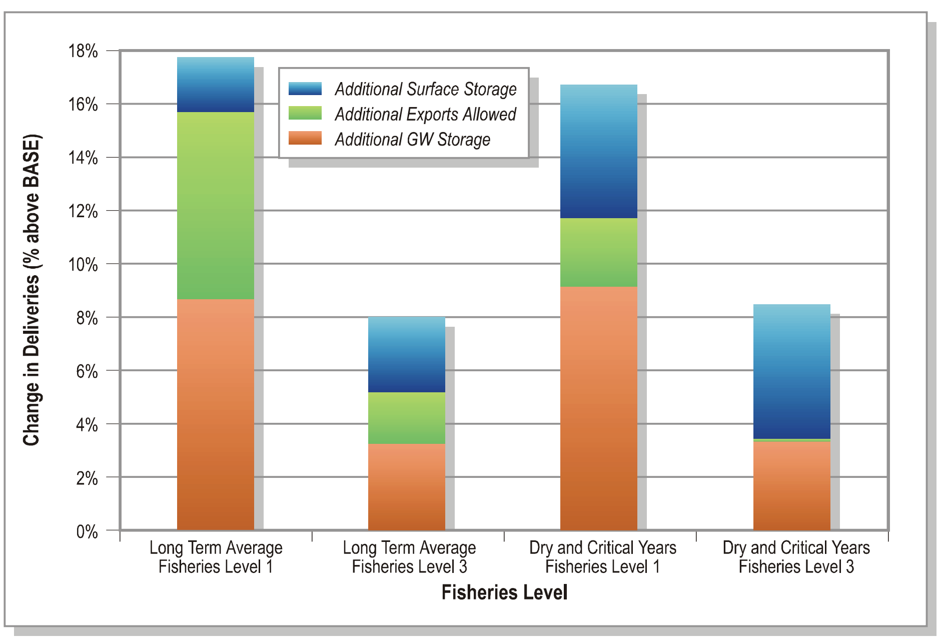

Figure 5-3 *Contributions from each resource change with increasing fishery benefits and during dry and critical years*

5.2 Next Steps

During the implementation of the ROD, many water management alternatives will require analysis and evaluation. Each analysis will present new challenges requiring continuous improvement of data and analytical tools. While project teams focused on specific water management proposals will be responsible for much of this work, further development and application of the CALFED Water Management Strategy Evaluation Framework can assist these efforts by providing:

- A clearinghouse for data and assumptions;
- A framework for consistent evaluations; and
- Analyses of combinations of water management proposals.

Towards this end, some of the tasks currently underway and planned for the near future are described below.

5.2.1 CALSIM

The alternatives described in this report were modeled using DWRSIM as the basic systems model. Since the WMS Evaluation Framework process began, the Department of Water Resources and U.S. Bureau of Reclamation have developed a new systems model called CALSIM. The CALSIM model is intended to replace DWRSIM, used primarily by DWR, and the PROSIM system model, used primarily by Reclamation. The CALFED Water Management Strategy team is working closely with DWR and USBR staff to integrate the new CALSIM model into future WMS Evaluation Framework studies.

5.2.2 Common Modeling Assumptions

Given the number of specific water management actions to be studied in the next few years, a number of different teams will be performing analyses simultaneously. Improved ability to share information across the different work teams is critical to providing information that can be used consistently by policy makers as well as systems analysts. One way to facilitate this information exchange is by developing a set of common modeling assumptions from which all alternatives will be formulated. Defining common modeling assumptions could provide greater clarity for people using the CALSIM model and allow for comparison of results from different alternatives.

5.2.3 Cost and Benefit Allocation

An important part of fully evaluating proposed water management actions is how economic costs and benefits will be shared (or allocated). Recognizing that these difficult issues must be addressed before any actions will be implemented, the CALFED WMS team is working closely with USBR's Division of Planning to develop methods to:

- Predict economic benefits and potential beneficiaries;
- Allocate economic benefits;
- Allocate economic costs; and
- Determine whether proposed water management actions are cost effective.

Large differences of opinion exist among the stakeholder community regarding these topics. Consequently, the WMS team has formed an expert panel of resource economists to review and comment on proposed cost and benefit allocation methods.

5.2.4 Finance Planning

Following evaluation of economic costs and benefits, various financing alternatives can be explored. The ROD requires the consideration of a user fee as part of the long-term finance plan for ecosystem restoration. The topic of finance for CALFED solutions will be addressed in detail once procedures for allocating economic costs and benefits are established.

5.2.5 Data Management

One of the greatest challenges faced during development and testing of the Evaluation Framework over the past two years has been data acquisition and data management. Large amounts of data are required to perform the comprehensive analyses. Sharing data between the various models has required extensive data handling and manipulation. Activities related to data preparation and manipulation have accounted for over 75 percent of the time spent analyzing alternatives.

One means for reducing data preparation time is to improve the WMS data management system, which is used to gather input data and archive, interpret and present output data. The CALFED WMS team has started a cooperative effort (with participation from a number of DWR and USBR work groups) to better understand the workflow and data flows related to information needed to evaluate water management actions. The California Water Plan update team is also evaluating existing data acquisition and management techniques in order to gather, store, transfer, and use information more efficiently and effectively. These two teams are pooling resources where possible, to improve this vital element of all technical analyses.

5.2.6 Model Improvements and Integration

To provide more useful information in a timely manner, CALFED is committed to continual improvement of its analytical tools. CALFED will continue to facilitate the development of new methods that can improve the ability to predict outcomes of proposed changes to the water management system. Two areas currently under development include:

1. A statewide economic optimization model named CALVIN intended to improve the ability to efficiently screen large numbers of alternatives.

2. Efforts to more effectively couple the different models to allow for an even more integrated analysis.

5.3 Conclusion

The goal of implementing durable water management solutions to achieve CALFED objectives has led many agencies and stakeholders to support a comprehensive approach to examining the likely effects and tradeoffs resulting from alternative strategies. As CALFED participants continue to learn more about various water management strategies, the tools supporting the WMS Evaluation Framework will continue to evolve.

Improving the analytical tools that support the Evaluation Framework will improve the information used to predict outcomes and make decisions about alternative water management strategies. The improvements will help policy makers and stakeholders apply the Evaluation Framework to gain understanding about how alternatives perform relative to CALFED objectives. With improved, timely, predictive information, decisions regarding water management strategies can help CALFED fulfill its mission.

Appendix A
Model Descriptions

A.1 Introduction

The CALFED Water Management Strategy Evaluation Framework (WMSEF) relies on a complex set of inter-linked computer models to predict results that describe the performance of water management alternatives. Operations of the Bay-Delta system are analyzed using several analyses. The initial analyses simulate system deliveries and transfers. The results are then run through an allocation program, which simulates the appropriate distribution of the “facility benefits” of various alternatives. The facility benefits available from an alternative are the new deliveries that the Bay-Delta system is capable of making, relative to the BASE case

This appendix presents an overview of the models used in the analyses. The models covered include: the Department of Water Resources Simulation Model (DWRSIM); the Delta Simulation Model II (DSM2); the Central Valley Production Model (CVPM); and the Central Valley Groundwater Simulation Model (CVGSM).

A.2 System Water Supply and Operations Modeling

The DWRSIM program is a regional planning model. It uses a network of control points to represent reservoirs, diversions, stream reach accretions and depletions, outflows, and pumping plants. The control points are connected by links representing river and canal reaches. The model includes all the major water conveying features in the Bay-Delta system.

DWRSIM was applied to simulate monthly operations over the 73-year hydrological record from 1922 to 1994. This time period was chosen because it contains a wide variety of types of hydrologic conditions, including multi-year droughts and wet periods. The 73-year data set is the standard hydrologic record used for all analyses.

As shown in Figure A-1, the results from DWRSIM are used for the water quality analysis, and then fed into a program for estimating transfers. This analysis simulates a voluntary regulated market and examines where transfers would occur. An upper limit for transfers is included in each alternative to reflect appropriate limitations. The results of this analysis indicate timing of transfers, the amount of each transfer and the regions involved in the transfer.

The model includes all the major water conveying features in the Bay-Delta system as listed below.

- The State Water Project (SWP) facilities:
  - Feather River system
  - Banks Pumping Plant and California Aqueduct

- The Federal Central Valley Project (CVP) facilities:
  - Trinity, Sacramento, American, and Stanislaus River systems
  - Joint Reach of the California Aqueduct, and CVP Share of San Luis Reservoir
- Local water supply facilities, including
  - Tuolumne and Merced River Systems
- The Sacramento -San Joaquin Delta, including:
  - CVP-SWP Coordinated Operating Agreement

Unique Delta Flow and Quality Standards

A.2.1 Assumptions and Model Input

The extensive list of assumptions specific to DWRSIM may be summarized by the following categories:

- Instream flow requirements;
- CVPIA Anadramous Fish Restoration Program flow criteria;
- Trinity River imports;
- Hydrology;
- Pumping plant capacities, coordinated operation and wheeling;
- Target reservoir storage;
- SWP demands, deliveries and deficiencies;
- CVP demands, deliveries and deficiencies; and
- Delta standards including quality objectives, Delta outflows, river flows and export limits.

Assumptions inherent in the DWRSIM analysis are detailed in CALFED Benchmark Study 2020D09A-CALFED-514.

The transfer analysis that was performed as part of the systems operations analysis also depended upon key assumptions, notably:

- All transfers are assumed to be a result of land fallowing, with no groundwater substitution involved (see discussion of Feasibility and Boundary Analysis.

- Urban users are the first beneficiaries of North of Delta transfers (before South of Delta agriculture) because they are assumed able to pay more for the transferred water.

The DWRSIM input include hydrology, water demand, network definitions, and operating characteristics. The transfer analysis performed as part of the systems operations analysis also depended upon the following key assumptions:

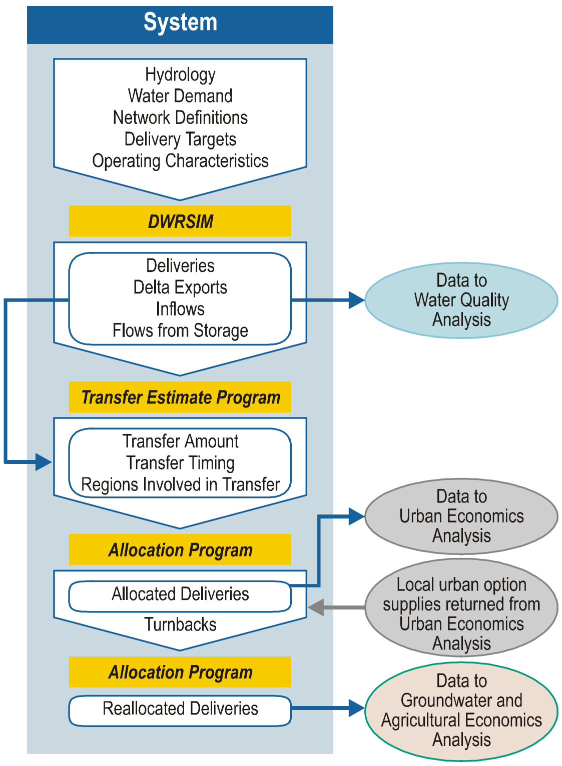

Figure A-1
System Analysis

Hydrology. The hydrologic inputs reflect 1995 level and 2020 level hydrology.

Demands. The demand input for the DWRSIM model is defined for development levels in two planning years, 1995 and 2020, matching the hydrology input development years. Separate demands have been developed for the SWP and CVP for each planning year. The demands for the SWP are variable as described in Section 2.2.1, and are based on the local wetness conditions. The CVP south of Delta contractor demands are fixed for both planning years.

Network Definition. The SWP / CVP system is represented in DWRSIM by a network of control points connected by links. Information describing the physical configuration and connectivity of the system is required to identify possible flow routes.

A.2.2 Operating Characteristics

Operational constraints are input for each control point, depending on whether the point represents a reservoir, channel reach, pumping station, or other component of the conveyance system. The operational constraints that must be input into DWRSIM are listed below.

- Minimum required Delta outflow
- Fish and wildlife flow requirements
- Flood control protection
- Minimum river flow
- Pumping / diversion restrictions
- Delta operational constraints
- Navigation flow requirements
- Local demands, water rights and contracts
- Pulse flow requirements

A.2.3 Model Applications

The most common application of the DWRSIM model is a long-term operation study in which the monthly operations of the CVP and SWP systems are simulated over the

73-year hydrological record from 1922 to 1994. The long-term operation study is conducted in order to evaluate the water supply impacts and delivery capability of different constraint scenarios as compared to a base scenario. DWRSIM simulates the availability, storage, use and export of water in the Sacramento-San Joaquin River systems, the Delta and the aqueduct and south of Delta reservoirs. The model operates the SWP and CVP systems to meet minimum instream flow requirements, minimum Delta outflow requirements and to provide maximum export from the Delta as allowed by physical, operational and regulatory constraints.

DWRSIM can also be used in firm yield operation studies. These studies are conducted to determine the nominal annual quantity of water that can be delivered to South of Delta contractors. The DWRSIM is configured to provide a specific system of facilities and operations to provide water through the 1928 through 1934 period, the most prolonged dry period of record in the Central Valley.

DWRSIM does not have the capability to model transfers, so a separate transfer analysis was performed for the comprehensive evaluation. This analysis was designed to simulate a free water market, and examine where transfers would occur. An upper limit for transfers has been included in each alternative to reflect appropriate limitations.

As noted above, the transfer analysis assumes that all transfer water is a result of land fallowing. When water is applied to a farm field, some water percolates to groundwater, and some water drains back into surface supplies. Only the portion of applied water that would be used consumptively by the crops can be sold to another water user, because only that portion of water is “saved” by fallowing the land.

Once the water is transferred from a north of Delta user, the transfer is subject to the export/import (E/I) ratio limitations. Furthermore, if the water cannot be pumped when it arrives in the Delta, then it flows into the ocean as Delta outflow. No upstream re-regulation of water supply is allowed either within year or from year to year.

The transfer analysis begins to transfer water during periods when urban deliveries are predicted to be below 70 percent of their target levels. Water is first transferred from agricultural users north of the Delta to urban users south of the Delta. Transfers from users north of the Delta are assumed to occur first because they will be more economically beneficial than other agricultural-to-urban transfers. If urban delivery targets are reached before the north of Delta transfer limit is reached, then water may be transferred from north of Delta agriculture to south of Delta agriculture.

If the north of Delta transfer limit is met before the urban users reach their delivery targets, then make-up water is assumed to be transferred from south of Delta agricultural users to south of Delta urban users. These transfers will occur until the urban users reach 90 percent of their delivery targets, or until the south of Delta transfer limit is reached.

A.2.4 Model Output

Model results provide monthly information over the 73-year period of hydrologic input record on many aspects of the water conveyance system. DWRSIM outputs include inflows and outflows, deliveries, changes in storage, and exports. The output of DWRSIM are used in a number of further analyses. DWRSIM output includes:

- SWP, CVP, and local system general operations
  - Delta export flows
  - Flow totals, diversions and restrictions in stream reaches
  - Reservoir water surface elevations, total storage, and release requirements
  - Delivery summaries by contractor
  - Power generation at reservoirs and power use at pump stations
- Monthly Delta operations
  - Inflows, outflows, and in-Delta uses
  - Cross channel gate position
- Daily Delta standards
  - Groundwater and conjunctive use monthly recharge, pumping, and total storage
- Stanislaus River operation
- Diversion shortage summaries

A.3 Delta Hydrodynamics and Water Quality Modeling

The hydrodynamics and water quality detailed analysis in the Delta are performed after the regional DWRSIM outputs are produced. The analysis is performed using Delta Simulation Model II (DSM2), which models the river system, estuary, and land processes of the Delta. The program consists of three main modules: hydrodynamics, water quality, and particle tracking. The hydrodynamic module simulates the channel flows, velocities, and

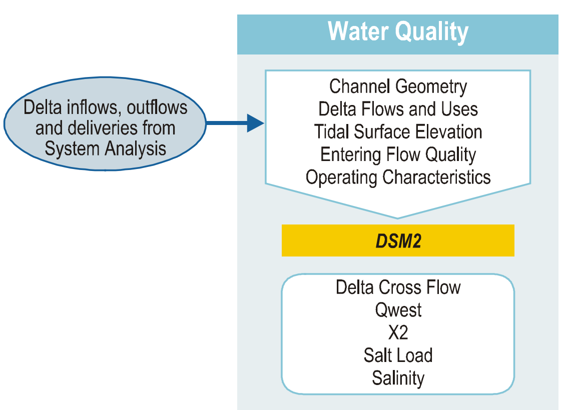

Figure A-2
Water Quality Analysis

water surface elevations in the Bay-Delta estuary. The resulting sequential traces of the water movement are subsequently input to the other two modules to determine the associated movement of constituents. The water quality module calculates the changes in water quality resulting from different source qualities and from the mixing due to water movement throughout the system. The particle-tracking module traces the path of a known point source mass after it has been inserted into the Delta. Figure A-2 illustrates the process. DSM2 simulations incorporate either short- or long-term hydrologic periods, along with flow conditions representing the full range of hydrologic conditions expected to occur in the Bay-Delta system.

A.3.1 Assumptions

Water Movement. The hydrodynamic module calculates flows and water surface levels in the Delta. To simplify the hydraulic calculations performed in the model, on a dimensional movement, with a constant cross sectional velocity across the channel cross section, is assumed.

Water Quality. Both the water quality module and the particle tracking module identify the movement of constituents within the Delta channels as a result of advection and dispersion. The water quality module assumes certain dispersion coefficients, which are generally selected based on empirical and theoretical studies, and on field measurements through the calibration and verification process.

Operations. In order to simulate Delta conditions, assumptions regarding the operation of several Delta structures were made. These structures include:

- Delta Cross Channel;
- Clifton Court Forebay Intake Gates;
- Suisun Marsh Salinity Control Gates;
- South Delta Flow Control Structures;
- Fish Control Structures at head of Old River; and

Hood Pumping Plant (if included).

A.3.2 Model Input

A number of variables are used to simulate Delta flows. They may be categorized as follows:

- Geometry and connections between the Delta channels;
- Flows entering the Delta and the water uses in the Delta;
- Tidal water surface elevations (which drive water into and out of the Delta);

- Water quality of flows entering the Delta; and
- Operating characteristics.

Geometry. The Delta is a network of interconnected channels, and includes water bodies created by the flooding of Delta islands. Channel lengths, cross-sectional geometry, and interconnections are model inputs. The channel cross-sectional geometries can be modified as necessary to reflect widening or deepening of channels.

Flows. Flow information is divided into Delta inflows and Delta outflows. The inflows to the Delta consist of the Sacramento River, the San Joaquin River, Yolo Bypass, and Eastside Streams. Outflows consist of net channel depletions, exports, and net Delta outflow. The exports include the major export pumping operations at the Tracy, Banks, North Bay, and Contra Costa Canal pumping plants. The net Delta outflow is the net flow into the San Francisco Bay, calculated by subtracting all Delta exports and diversions from inflows.

Channel depletions are estimated with the Delta Island Consumptive Use Model. The model, on a monthly time step, keeps track of water that enters, leaves, and is stored in the Delta, representing about 1,800 agricultural diversion points. It utilizes factors such as acreage, crop type, runoff, leach water, soil moisture storage, irrigation, evapotranspiration, seepage and precipitation.

Tidal Water Surface Elevations. Tidal levels are input to represent the influence of tidal action within the Delta. The tidal input is the boundary tide at Martinez in the Carquinez Strait. This tidal input is either the actual measured values or the 19-year mean tide. The measured values are generally used when the simulation time period is only a few months. For planning studies that simulate years of flow data, the 19-year mean tide at Martinez is typically used.

Water Quality. Daily average salinity at Martinez was generated by another DWR model, SALDIF. This model predicts the salinity at Martinez given the Net Delta Outflow index. The salinity of Sacramento River flows, Yolo bypass inflows, and Eastern Delta inflows were assumed constant at given values. The salinity of the San Joaquin River inflow was generally obtained from DWRSIM simulation results.

A.3.3 Model Applications

Delta hydrodynamic simulations were performed with DSM2 using Delta inflow hydrology inputs from the DWRSIM project operations simulations. Inputs to DSM2 were modified to represent different Delta geometries and export diversion locations.

DSM2 simulations incorporated either short term or long term hydrologic periods. Hydrodynamic impacts of alternatives over these periods were evaluated based on in-Delta modifications and changes in CVP and SWP operations. Several Delta channel flows were evaluated and summarized for each alternative. For each alternative, Delta channel stage was evaluated and summarized at two locations.

The DSM2 model was used to perform several mass tracking simulations for existing conditions and alternatives. Mass tracking simulations provide assessments of particle movement in the Delta under different hydrologic conditions. The transport and fate of mass released into the Delta at various locations was simulated for the following flow conditions:

- High inflow / high pumping, represented by February 1979;
- Medium inflow / low pumping, represented by April 1991;
- Low inflow / high pumping, represented by October 1989; and
- Low inflow / low pumping, represented by July 1991.

These flow conditions represent the full range of hydrologic conditions expected to occur in the Bay-Delta system. The months indicated were selected based on combinations of high and low events of inflows and high and low export conditions. Through the model studies, mass release was simulated at three discrete locations in the Delta to determine its fate. Differences between alternatives were evaluated for all three injection points by comparing the changes in distribution of mass after 30 days. The distribution of mass was evaluated by determining the relative percentages of mass reaching predetermined locations.

A.3.4 Model Output

The DSM2 Delta model output includes: the instantaneous water surface stage, flow, velocity, and salinity at each cross section and junction. Long-term average results for the WMS alternatives reported in this document include cross Delta flow, X2, and salinity and salt loading at Rock Slough. In some cases, the time step determines the type of output. For example, when the monthly average flow and tide data are used in the model, the results are monthly average values. These results typically include:

The outputs from the DSM2 model include the instantaneous water surface stage, flow, velocity, and salinity at each input cross section and junction in the Delta model. In some cases, the input information time step will determine the type of output information. For example, when the monthly average flow and tide are used in the model, the results will be monthly average values. These results would typically include:

- Monthly average net flows, tidal velocities and stages in Delta channels;
- Monthly maximum and minimum net flows, tidal velocities and stages;

- Monthly average Delta flow patterns at several locations in the Delta, including cross Delta flow and Qwest;
- Changes in monthly average salinity including X2 location; and
- Changes in the fate of mass released at particular locations in the Delta.

If the input data for flow and tidal stage are hourly, the maximum, minimum and average values over a single tidal period (25 hours) can be identified.

A.3.5 Summary

The entire Delta is under the influence of ocean tides that have a significant effect on the water movement and constituent transport processes. One of the limitations of the modeling results is the extent to which the tidal hydrodynamics create a widely varying flow and water surface elevation throughout a single tidal period. This wide variation makes it difficult to summarize the differences between the effects of model alternatives. The vast amount of complex hydrodynamic and water quality data must be simplified to facilitate the relative comparison and evaluation of alternatives. The following indicators are adopted performance measures of the complex and variable Delta flow and water quality conditions.

- **Cross Delta flow** - Net combined flow through the channels that carry Sacramento River and San Joaquin River water from the Sacramento area to the Central Delta.
- **Qwest** - Net combined flow through the combination of channels that carry water from the Central Delta towards the Bay; Qwest is a descriptor of water quality trends in the Central and South Delta, low Qwest values indicate potential problems with saline water intrusion.
- **X2** - The distance upstream from the Golden Gate Bridge (in km) at which mixing of freshwater from the Delta inflow and saltwater from the Bay results in a channel bottom salinity of two parts per thousand. Because Delta salinity is primarily a result of seawater intrusion, X2 is mainly a measure of such intrusion, however, upstream sources such as agricultural drainage from the San Joaquin Valley also contribute to Delta salinity and to the values of X2.
- **Residual flow** - The net flow in a direction over a tidal period; this net flow is quite small in comparison to the peak flow at the same point.
- **Maximum, minimum ,or average water stage** - A single water elevation representing mean water depth over a 25-hour tidal cycle.

Changes in these parameters are used to predict the effects of alternative actions on hydrodynamic and water quality conditions in the Delta. Additional modeling output data is required to better predict the performance of the above indicators.

A.4 Urban Economic Evaluations

DWR's Least-Cost Planning Simulation Model (LCPSIM), depicted in Figure A-3, was used to determine the economic feasibility of various regional urban water supply alternatives. It was also used to formulate combinations of regional supply enhancement options that could be used in the Water Management Strategy Evaluation Framework (WMSEF) analyses. The analysis only includes permanent long-term options. LCPSIM uses water deliveries and projected demands to predict results that are performance measures in the Water Management Strategy Evaluation Framework. LCPSIM was applied to the South Coast and the Bay Area regions.

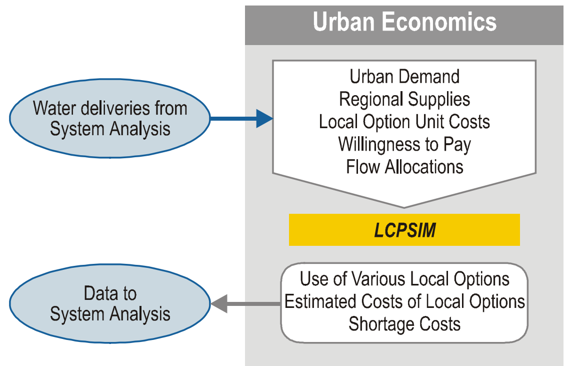

Figure A-3
Urban Economics Model

The economic analysis is based on the premise that when urban users experience shortages, they incur economic, social, and environmental costs that may be prevented by the implementation of water reliability-improving options. The analysis evaluates the economic feasibility of increasing urban water reliability by comparing the costs of water reliability improvement options to the costs of shortages. Options that are less expensive than shortages are more favorable from an economic standpoint than options that may provide reliability, but which are more costly than undergoing shortages.

The urban economic analysis used a yearly time-step on 73 years of hydrologic data to predict regional options packages. A period of the hydrologic record was selected to provide a sufficient range of possible Delta impacts. The economic analysis evaluated the sensitivity of urban economic costs to changes in the following:

- Amount of storage carryover,
- Allocation of water from new storage to municipal and industrial users,
- Water transfers,
- Demand hardening, and
- Regional option costs.

A.4.1 Model Input

Input to the LCPSIM includes the cost estimates for water reliability options as well as flow allocation results from both DWRSIM and the post-processing allocation model. The analysis uses a willingness to pay approach for estimating the costs of shortages.

That is, the costs of shortages are measured by estimating how much urban users would be willing to pay to avoid a shortage of water. Key data about shortages that are considered are the frequency, size, and impacts of shortages. The analysis assumes that users will always choose the option with the lowest cost.

A.4.2 Model Output

Using the least cost planning approach, LCPSIM predicts the local response of urban users to the assumed hydrology and flow allocation scheme prescribed by the various alternatives under analysis. For each alternative, LCPSIM results show the expected water supply that urban users will develop locally using the following approaches:

- Recycling;
- Conservation / Re-Use;
- Groundwater; and
- Ocean Water Desalting.

Recycling includes options that involve highly treated water that has already been used, and re-use includes options that re-use water without extensive treatment. The results show both the estimated costs for all of these options, by region, and the additional costs associated with the projected shortages that would remain likely based on a least-cost approach to development.

A.4.3 Summary

The LCPSIM uses a quantitative measurement to compare the costs and benefits of water reliability options. All categories of costs and benefits associated with shortages are measured using dollars. While this is a necessary convention for comparison purposes, there are limitations associated with this method. These include:

- Some social and environmental costs and benefits associated with water reliability are not readily translatable to economic terms.
- The actual selection of regional reliability options may incorporate political factors that are not accounted for in the inherent assumption of least-cost decision-making.

LCPSIM does not take into account the economic costs and benefits of the water quality factors produced by the alternatives. It also does not account for environmental costs not considered in the Environmental Water Account.

A.5 Groundwater

A groundwater analysis was performed using the Central Valley Ground-Surface Water Model (CVGSM), which represents interactions between regional aquifers and major streams. Figure A-4 shows the basic concepts. The CVGSM considers and predicts hydrologic components and their interactions, including evapotranspiration, direct runoff, infiltration, and deep percolation from rainfall and irrigation applied water. The model uses a monthly time step to simulate these interactions and predict results. The groundwater analysis covers the entire Central Valley, from Redding to Bakersfield. This region is divided into 21 subregions, which are defined by hydrologic and water service boundaries. There are 9 subregions in the Sacramento Valley, and 12 in the San Joaquin Valley. Groundwater results are produced for each subregion.

For the WMSEF analysis, the CVGSM was applied to the historical rainfall data from 1922 to 1990. This period exhibited a variety of hydrologic conditions, including both floods and droughts that lasted several years. This historic data was assumed to be representative of a wide variety of conditions that could occur in the future.

A.5.1 Assumptions

The CVGSM assumes that land use and crop acreage is not dependent on the availability of surface water and groundwater pumping. The CVGSM must have land use as input from the agricultural production model, but the agricultural production model needs groundwater levels in order to calculate land use. To account for these interactions, the groundwater model must be run in conjunction with the agricultural production model. These two models are often run iteratively, with the results from one model fed into the other model until they on a solution. However, the comprehensive evaluation has streamlined this process by creating a set of "response curves" from the CVGSM. A series of alternatives, representing a wide range of conditions, was run through the CVGSM. These alternatives were used to generate the response curves illustrating the depth to groundwater based on the input conditions. The response curves were then used with the agricultural production model instead of running both models repeatedly.

A.5.2 Model Input

The CVGSM uses hydrologic and other information listed below to evaluate an alternative water management action that effects ground-surface water interaction.

- Land use;
- Crop acreage;
- Precipitation;
- Groundwater pumping;
- Initial surface water flows;

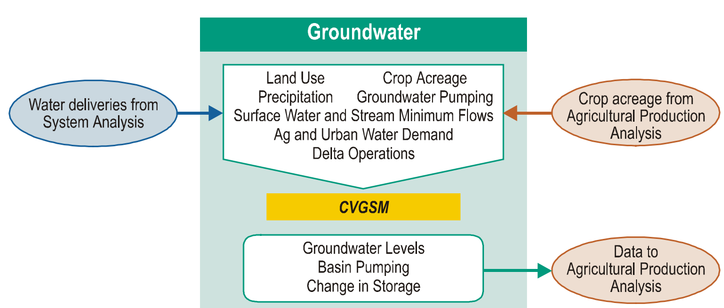

Figure A-4
Groundwater Analysis

- Minimum streamflows;
- Agricultural water demand;
- Urban water demand; and
- Delta operations data.

Agricultural demand is determined by using crop acreage and the amount of water necessary for each crop. This demand is assumed to be met first by precipitation, with remaining demand met by surface water deliveries, and then by groundwater pumping.

The remainder of the input information necessary to apply the was derived from the results of the system operations and agricultural production models. The CVGSM utilizes this information to simulate the groundwater and surface water interactions throughout the Central Valley.

A.5.3 Model Applications

For the Comprehensive Evaluation, the CVGSM was applied to the historical rainfall data from 1922 – 1990. This period exhibited a variety of hydrologic conditions, including both floods and droughts that lasted several years. This historic data was assumed to be representative of a wide variety of conditions that could occur in the future.

The model uses a monthly time step to predict results. The groundwater analysis, which covers the entire Central Valley from Redding to Bakersfield, includes an area of 19,710 square miles. This region is divided into 21 subregions, which are defined by hydrologic and water service boundaries. There are nine subregions in the Sacramento Valley, and 12 in the San Joaquin Valley. Each subregion is further divided into elements with an average size of 14.5 square miles, and model data is aggregated over the area of each element. The CVGSM uses a total of 1,392 elements throughout the entire Central Valley.

The remainder of the input information necessary to apply the CVGSM to the alternatives was derived from the results of the Comprehensive Evaluation analyses, including system operations and agricultural production.

A.5.4 Model Output

Among the outputs of the CVGSM are groundwater levels, basin pumping and changes in storage. Initial outputs of the CVGSM must be run through CVPM, as noted above, to get land use results for further analysis. The CVGSM predicts the following data by subregion:

- Monthly groundwater levels;

- Monthly streamflows;
- Water use budget;
- Streamflow budget;
- Soil moisture budget;
- Groundwater budget; and
- Diversion and shortage (by individual diversion).

These outputs provide the basis for performance prediction for each alternative, including land subsidence by region.

A.6 Agricultural Production

The agricultural production and related economic analysis was performed using the Central Valley Production Model (CVPM), created by DWR and updated by USBR. The CVPM is a regional model of irrigated agriculture within the Central Valley that simulates farmers' decisions when faced with changing hydrologic and economic conditions, and predicts resulting changes in land and water use. Figure A-5 shows the CVPM modeling process.

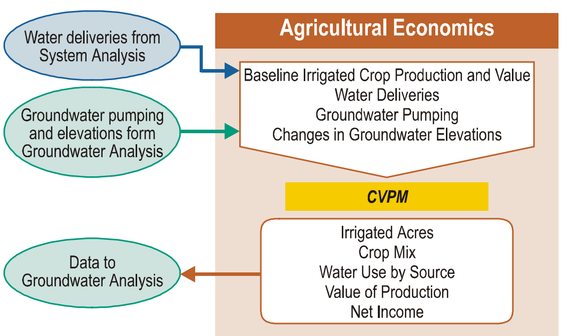

Figure A-5
Agricultural Economics Analysis

The CVPM assumes that farmers will maximize profit subject to resource, technical, and market constraints. Farmers sell and buy in competitive markets, and no one farmer can affect or control the price of any commodity. The CVPM is designed to maximize the sum of farmers' net income and the net value of agricultural products.

These relationships are used to simulate farmers' short-run and long-run decisions. The purpose of the short-run model is to identify farmers' best possible decisions under temporary situations (5-7 year wet or dry periods), and the associated agricultural production impacts. The long-run analysis estimates economic impacts after farmers have made decisions that reflect permanent changes in water availability and economic conditions.

The model considers 22 crop-producing regions, and 26 categories of crops. The CVPM is run for a variety of hydrologic conditions, including the long-term average, the 1928 through 1934 critical drought period, the 1967 through 1971 wet period, and a critically dry condition as the 10 percent driest years of record. The results from these separate model runs can be analyzed to predict the impacts of each alternative for the WMSEF.

A.6.1 Assumptions

The CVPM assumes that farmers will maximize profit subject to resource, technical, and market constraints. Farmers sell and buy in competitive markets, and no one farmer can affect or control the price of any commodity. The CVPM is designed to maximize the sum of farmers' net income and the net value of agricultural products to consumers based on the following conditions:

- As a farmer's production increases, the cost per acre increases and the revenue per acre also increases, if the price per unit of production is unchanged. The model assumes diminishing net returns per acre as production increases.
- Each crop has a unique relationship indicating how much a decrease in the total quantity produced will increase the market price of that crop.
- Farmers will select the least-cost irrigation technology, considering both the cost of water and the amount of water required for different irrigation technologies.
- A farmer's productivity will be impacted by land and water availability, as well as legal, physical and economic limitations.

These relationships are used to simulate farmers' short-run and long-run decisions. The purpose of the short-run model is to identify farmers' best possible decisions under temporary situations (5-7 year wet or dry periods), and the associated agricultural production impacts. The long-run analysis estimates economic impacts after farmers have made decisions that reflect permanent changes in water availability and economic conditions.

The CVGSM assumes that land use and crop acreage is not dependent on the availability of surface water and groundwater pumping. To account for these interactions, the groundwater model must be run in conjunction with the agricultural production model .

Agricultural demand is determined by using crop acreage and the amount of water necessary for each crop. This demand is assumed to be met first by precipitation, with remaining demand met by surface water deliveries and then by groundwater pumping.

A.6.2 Model Input

The CVPM requires the following information to perform an analysis on the Central Valley:

- Baseline irrigated crop production and value;
- Water deliveries from the system analysis;
- Groundwater pumping; and

- Changes in groundwater elevations.

The baseline irrigated crop production is derived from several sources, including County Agricultural Commissioner Reports and Department of Water Resources Bulletin 160 Reports. Water deliveries are predicted by the system operations analysis. Groundwater pumping and changes in groundwater elevations are predicted by the groundwater analysis. The groundwater analysis was performed before the use of the CVPM, and produced “response curves.” The response curves are then used to provide groundwater information for the CVPM.

A.6.3 Model Applications

The CVPM attempts to model the wide diversity of crops within the Central Valley. Most models assume average conditions, such as average production costs, yields, and prices, and try to optimize profits based on these factors. This methodology, however, will result in the most profitable crop being produced everywhere until resources (land, water, capital) are exhausted.

In reality, farming conditions vary by region, and the average conditions almost never occur. To account for these variations, the CVPM incorporates marginal (incremental) conditions in addition to average conditions. This methodology predicts a wider range of crops being cultivated in the Central Valley.

To ensure that the crop mix is reasonable, the model is calibrated with the applied water and land use data from 1987 – 1990, during which time deliveries were approximately equal to contract amounts.

The CVPM incorporates U.S. Department of Agriculture commodity programs, as authorized in 1990 farm legislation, but does not include the changes that have been incorporated since 1990. The legislation is regularly updated, which makes predictions of future changes difficult. Therefore, only the base conditions are incorporated into the CVPM predictions.

A.6.4 Model Output

The CVPM model output includes irrigated acreage, crop mix, water use by source, the value of production and net income. As described above, the agricultural economics analysis must be run in conjunction with the groundwater analysis until both models predict the same amount of pumping.

The CVPM predicts the following:

- Irrigated acreage;
- Crop mix;
- Water use by source;

- Irrigation efficiency (long-run only);
- Value of production; and
- Net income.

These results, from both short- and long-term model runs, have been analyzed to predict the performance of the WMS alternatives.

A.6.5 Summary

The CVPM is designed to maximize profit based on a pre-determined set of conditions, including water supplies, pricing, and economic markets. Actual farmers will not have immediate access to accurate predictions of this information, and will therefore not always make the optimal decisions. Because of this limitation, the model will often predict greater levels of profits than the farmers will actually experience when they are forced to make decisions. The model considers 22 crop-producing regions, and 26 categories of crops as shown in Table A-1.

Table A-1
CVPM Crop Groupings

Category	***Proxy Crop[1]***	***Other Crops[2]***	***Unit of Measure***
Wheat	Wheat		Tons
Miscellaneous grain	Barley	Oats, sorghum	Tons
Rice	Rice		Tons
Cotton	Upland cotton	Pima cotton	480-lb bales
Sugar beets	Sugar beets		Tons
Corn	Field corn	Miscellaneous field crops	Tons
Miscellaneous hay	Grain hay	Sudan grass, other silage	Tons
Dry beans	Dry Beans	Lima beans	Tons
Oil seed	Safflower	Sunflower	Tons
Alfalfa seed	Alfalfa seed	Wild rice, miscellaneous seed crops	Tons
Alfalfa	Alfalfa hay		Tons
Pasture	Irrigated pasture		Animal Unit Months
Processing tomatoes	Processing tomatoes		Tons
Fresh tomatoes	Fresh tomatoes		Tons
Melons	Cantaloupe	Honeydew, watermelon	Tons
Onions	Dry onions	Dry & fresh onions, garlic	Tons
Potatoes	White potatoes		Tons
Miscellaneous vegetables	Peppers	Carrots, cauliflower, lettuce, peas, spinach, broccoli, asparagus, sweet potatoes, other truck vegetables	Tons
Almonds	Almonds	Pistachios	Tons
Walnuts	English walnuts		Tons
Prunes	Prunes	Plums and apricots	Tons
Peaches	Peaches	Nectarines, pears, cherries, apples, miscellaneous deciduous fruit	Tons
Citrus	Oranges	Lemons, grapefruit, miscellaneous subtropical fruit	Tons
Olives	Olives	Figs, kiwis, avocados,	

Table A-1 ***CVPM Crop Groupings***			
Category	***Proxy Crop[1]***	***Other Crops[2]***	***Unit of Measure***
		pomegranates	Tons
Raisin grapes	Raisins	Table grapes	Tons
Wine grapes	Wine grapes		Tons
[1] Production costs, yields, and prices for this crop used in the CMPM. [2] Acreage data for these crops summed with the proxy crop			

The CVPM is run for a variety of hydrologic conditions, including a dry short-term, a wet short-term, and a dry long-term. The following hydrologic regimes are used as surrogates for these conditions:

- Dry short-term: 1928 – 1934 drought;
- Wet short-term: 1967 – 1971 wet period;
- Long-term Average: 1922 – 1990.

The results from these separate model runs can be analyzed to predict the impacts of each alternative for the WMS.

Appendix B
Summary Tables for the Comprehensive Analysis of Example Alternatives

The attached tables summarize the results from the comprehensive analysis approach explained in Section 2. The two initial tables are summaries for the long-term average results and the dry and critical year averages, respectively. The tables following these summaries include the following groups:

- Long-term average results by region; and
- Dry and critical year average results by region.

The following definitions help to explain results found in the tables.

"Water Supply Allocation Summary" Tables

Delta Export Reduction Schedule Fishery benefit level, as explained in Section 3.

Base Bay-Delta Supply Base level water exports from the Bay-Delta, regardless of CALFED actions.

Sacramento R. Basin Transfer to Urban North-of-Delta transfers to south-of-Delta urban users (NOD transfers).

Facility Benefit Increase in water exports from the Bay-Delta system due to new CALFED actions, including groundwater storage, surface storage, and changes in export pumping.

Unused Facility Benefit Excess water from CALFED actions, resulting from the imperfect linking of simulations, that cannot be justified economically.

Interruptible Supplies available to Bay-Delta system exporters during the wet season, after San Luis Reservoir is filled.

Total Bay-Delta Deliveries Total water exported from the Bay-Delta system, including base supply, NOD transfers, facility benefits, and interruptible supplies.

Total ERP Water supplies allocated to the ERP, as explained in Appendix C.

San Joaquin/Tulare to Urban Reallocation Water transfers from south-of-Delta agriculture to south-of-Delta urban users (SOD transfers). These transfers are not included in the "Total Bay-Delta Deliveries" because they are a reallocation of water already exported, not an increase in total exports.

Tracy Ave Peak TDS (mg/L) Average TDS concentration at Tracy Pumping Plant.

Banks Ave Peak TDS (mg/L) Average TDS concentration at Banks Pumping Plant.

ERP Acquisitions *(by Region)* ERP water flows within each region.

Net Water Transfer *(Sacramento Region)* Quantity of North of Delta transfers that is received by the purchasing regions.

Water User Transfer Acquisitions *(Sacramento Region)* Quantity of water that is transferred out of the Sacramento Region.

Salt Load *(Bay Area, Coast, and South Coast)* The tons of salt per year present in the water delivered to each region.

Salt Load @ Edmonston *(South Coast)* Salt load at Edmonston pumping plant.

Detailed Results Tables

System Operations

Trinity Imports *(Sacramento Region)* Water supply from the Trinity River.

Tulare Basin (James Bypass) Inflow *(San Joaquin Region)* Water inflow into the San Joaquin Region from the Tulare Basin through the James Bypass.

Friant-Kern Imports *(Tulare Region)* Water inflow from the San Joaquin Region through the Friant-Kern canal.

Hetch-Hetchy & Mokelumne Imports *(San Francisco Bay Region)* Imported water that does not travel through the Bay Delta system. This figure is assumed constant for all alternatives, and is used for the urban economics modeling.

Other Imports *(Central & South Coast Regions)* Water imported from areas other than the Bay-Delta system, including the Colorado aqueduct, LA aqueduct, and fixed supply from regional options. These imports are assumed constant for all alternatives, and are used for the urban economics modeling.

Unstored Inflow Water that enters the region, but is not captured by surface or groundwater storage.

Stored Inflows Water that is captured by storage, divided into existing storage, new groundwater storage, and new surface storage.

Upstream Exports Water that is exported to customers before the water enters the Bay-Delta System.

Total Delta Import Deliveries Water received from the Bay-Delta system, divided according to the source of water (Base Bay-Delta Supply, New Facility Benefit, Interruptible, and Net Bay-Delta Supply). Transfers can be decreases (San Joaquin or

Tulare transfers to urban) or increases (Bay Area, Central and South Coast) to the total deliveries.

Outflow Water that leaves each region, divided by the source of inflow (unstored, existing storage, or new storage) or transfers.

Carryover Storage Average water stored at the beginning of each year because it was "carried over" from the previous year, divided into existing storage, new surface storage, or new groundwater storage.

Maximum Storage Largest volume of water stored by existing storage, new surface storage, and new groundwater storage.

Shasta Levels Number of modeled years in which the storage in Shasta Lake goes below a given level of storage.

Regional Option Use Water supplied from regional options, including recycling, conservation / re-use, groundwater, and ocean water desalting.

Consumptive Use of Applied Water Intended to illustrate the end water users, but results are not yet complete.

Mean X2 Position The distance upstream from the Golden Gate Bridge (in km) to the point where the daily average salinity is 2 parts per thousand.

Mean Qwest Net combined flow through the combination of channels that carry water from the Central Delta towards the Bay; Qwest is a descriptor of water quality trends in the Central and South Delta, low Qwest values indicate potential problems with saline water intrusion.

Delta Cross Flow Net combined flow through the channels that carry Sacramento River water and San Joaquin River water from the Sacramento area to the Central Delta.

Water Quality

Salt Load See description under summary tables.

Salinity Salinity concentration in parts per million.

Economic/Land Use

Regional Value of Production Agricultural production in each region.

Statewide Value of Production Total agricultural production within the modeled area (the Central Valley).

Employment Change (# jobs) Irrigated Production The change in the number of jobs in the region due to the change in irrigated agricultural production.

Employment Change (# jobs) Transfer Revenue The change in the number of jobs in the region due to increased transfer revenue.

Total Employment (# jobs) Total employment, taking into account the net change in the number of jobs from both changes in agricultural production and transfer revenue.

Total Basin Land Use Thousands of acres in agricultural production, by crop type.

Number of Land Fallow Transfers Number of transfers that occur. This modeling effort only allows transfers from land fallowing.

Marginal Cost of Transfers Cost to the farmer of transferring the last acre-foot of water.

Urban Economics

Total Cost of Supplies Intended to provide estimated costs of water supplies, but work is not yet complete.

Total Local Option Cost Total costs of regional options that are implemented and shortages incurred. The regional option costs include the costs to implement the necessary amount of recycling, conservation, groundwater, or ocean water desalting. The shortage cost indicates the costs associated with the shortages that remain after regional options are implemented.

Marginal Fixed Option Cost Per unit cost of regional fixed options

Treatment Costs Assumed cost of water treatment in urban regions

Groundwater

Total Basin Pumping Total groundwater pumped out of the Central Valley basin in the region.

Pumping Costs Per unit cost of groundwater pumping.

Groundwater Levels Average groundwater level, by model subregion (illustrated in groundwater results in Section 4).

Annual Change in Storage The annual change in the amount of groundwater storage in the basin.

Non-Recoverable Losses Water that percolates to an area that is not recoverable, such as a salt sink.

Net Deep Percolation The amount of water that percolates into the groundwater basin.

Gain from Stream Groundwater increases due to percolation from the region's streams and rivers.

Conjunctive Use Area Describes the parameters of each potential conjunctive use area in the specific region.

Water Supply Allocation Summary

Long-Term Period

Accounting Total of Delta Deliveries & Water Quality; Sacramento

Alternative Configuration		Delta Export Reduction Schedule	Base Deliveries	Facility Benefit	Sacramento R. Basin (NOD) Transfer to Urban	Unused Facility Benefit	Interuptible	Total Bay Delta Deliveries	Total ERP Acquisitions (from willing sellers)	San Joaquin / Tulare (SOD) to Urban Reallocation	Tracy Ave Peak TDS (mg/l)	Banks Ave Peak TDS (mg/l)	Sacramento: ERP Acquisitions (from willing sellers)	Sacramento: Net Water Transfer	Sacramento: Water User Transfer Acq. (Total NOD Transfer Supply)	Sacramento: Number of Years Transfer Occurs
Exist Cond.		N/A	4454	0	0	0	204	4658	0	0	282	261		0		0
Exist Cond.		1	4307	0	0	0	171	4478	0	0	282	262		0		0
No Action		N/A	4899	0	0	0	130	5029	0	0	286	264		0		0
No Action		1	4709	0	0	0	98	4807	0	0	285	264		0		0
BASE		N/A	4460	0	0	0	204	4664	0	0				0		0
BASE		1	4315	0	0	0	171	4486	0	0				0		0
Alternative A	Supply	1	4315	325	7	0	225	4872	277	82	290	267	201	7	15	12
Alternative A	Supply	2	4315	197	13	0	190	4717	275	158	290	267	199	14	28	23
Alternative A	Supply	3	4315	139	14	0	161	4630	273	226	286	264	197	15	41	33
Alternative A	WQ	1	4315	250	10	0	212	4788	281	116	252	237	205	11	21	17
Alternative A	WQ	3	4315	98	15	0	160	4589	275	240	264	247	199	16	43	35
Alternative B	Supply	1	4315	751	20	-1	193	5279	275	62	291	267	199	20	40	9
Alternative B	Supply	2	4315	566	21	-1	176	5078	273	75	290	266	196	21	48	11
Alternative B	Supply	3	4315	336	30	-1	162	4844	268	130	285	263	192	30	82	19
Alternative B	WQ	1	4315	683	25	-1	183	5206	280	75	257	240	204	25	48	11
Alternative B	WQ	3	4315	314	32	-1	149	4811	270	130	271	251	193	32	82	19
Alternative B No Surface	Supply	1	4315	680	25	-2	167	5188	279	75			203	25	48	11
Alternative B No Surface	Supply	2	4315	478	30	-1	140	4963	275	103			199	30	64	15
Alternative B No Surface	Supply	3	4315	226	44	-1	132	4718	265	171			189	44	108	25
Alternative B No Surface	WQ	1	4315	598	29	-2	155	5098	282	89			206	29	56	13
Alternative B No Surface	WQ	3	4315	226	44	-2	132	4718	265	171			189	44	108	25
Alternative C	Supply	1	4315	735	9	-1	193	5252	275	41	290	266	199	9	19	15
Alternative C	Supply	2	4315	561	11	-1	176	5063	273	49	290	266	196	11	22	18
Alternative C	Supply	3	4315	332	12	-1	162	4822	268	63	285	262	192	12	29	23
Alternative C	Supply	1	4315	653	10	-1	188	5167	270	44	291	267	194	10	20	16
Alternative C	WQ	1	4315	671	35	-1	183	5204	280	47	257	240	204	35	74	17
Alternative C	WQ	3	4315	312	36	-1	149	4814	270	63	271	251	193	38	100	23
Alternative C No Surface Storage	Supply	1	4315	659	11	-2	167	5152	279	44			203	11	20	16
Alternative C No Surface Storage	Supply	2	4315	473	11	-1	140	4940	275	52			199	11	24	19
Alternative C No Surface Storage	Supply	3	4315	224	13	-1	132	4685	265	68			189	13	31	25
Alternative C No Surface Storage	WQ	1	4315	579	12	-2	155	5061	282	49			206	12	23	18
Alternative C No Surface Storage	WQ	3	4315	224	13	-2	132	4685	265	68			189	13	31	25

San Joaquin; Tulare

Alternative Configuration		Delta Export Reduction Schedule	San Joaquin: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer to Urban	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	ERP Acquisitions (from willing sellers)	Tulare: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer to Urban	Interuptible	Total Bay-Delta Supply (w/ Interruptible)
Exist Cond.		N/A	1140	0	0	0	0	1140		1697	0	0	0	199	1896
Exist Cond.		1	1096	0	0	0	0	1096		1623	0	0	0	166	1788
No Action		N/A	1131	0	0	0	0	1131		1712	0	0	0	103	1816
No Action		1	1085	0	0	0	0	1085		1616	0	0	0	76	1693
BASE		N/A	1142	0	0	0	0	1142		1551	0	0	0	199	1749
BASE		1	1093	0	0	0	0	1093		1467	0	0	0	166	1633
Alternative A	Supply	1	1093	14	0	-39	0	1067	76	1467	46	0	-39	219	1693
Alternative A	Supply	2	1093	7	0	-68	0	1033	76	1467	25	0	-71	186	1608
Alternative A	Supply	3	1093	4	0	-92	0	1006	76	1467	14	0	-99	157	1540
Alternative A	WQ	1	1093	13	0	-54	0	1052	76	1467	46	0	-58	207	1662
Alternative A	WQ	3	1093	5	0	-97	0	1001	76	1467	17	0	-105	156	1534
Alternative B	Supply	1	1093	52	0	-30	0	1115	76	1467	186	0	-32	152	1774
Alternative B	Supply	2	1093	38	0	-36	0	1095	76	1467	143	0	-39	139	1710
Alternative B	Supply	3	1093	17	0	-60	0	1050	76	1467	65	0	-69	129	1592
Alternative B	WQ	1	1093	58	0	-37	0	1114	76	1467	204	0	-38	144	1777
Alternative B	WQ	3	1093	18	0	-60	0	1051	76	1467	70	0	-67	119	1589
Alternative B No Surface	Supply	1	1093	46	0	-37	0	1102	76	1467	171	0	-38	132	1732
Alternative B No Surface	Supply	2	1093	38	0	-49	0	1081	76	1467	144	0	-53	111	1669
Alternative B No Surface	Supply	3	1093	15	0	-79	0	1029	76	1467	60	0	-92	103	1538
Alternative B No Surface	WQ	1	1093	49	0	-43	0	1098	76	1467	179	0	-46	123	1723
Alternative B No Surface	WQ	3	1093	15	0	-79	0	1029	76	1467	60	0	-92	103	1538
Alternative C	Supply	1	1093	113	0	-19	0	1188	76	1467	371	0	-23	152	1967
Alternative C	Supply	2	1093	87	0	-22	0	1157	76	1467	289	0	-27	139	1869
Alternative C	Supply	3	1093	51	0	-28	0	1117	76	1467	176	0	-32	129	1740
Alternative C	Supply	1	1093	102	0	-20	0	1175	76	1467	338	0	-24	146	1927
Alternative C	WQ	1	1093	103	0	-21	0	1175	76	1467	342	0	-25	144	1928
Alternative C	WQ	3	1093	45	1	-27	0	1112	76	1467	159	1	-29	119	1718
Alternative C No Surface Storage	Supply	1	1093	99	0	-20	0	1172	76	1467	334	0	-24	132	1910
Alternative C No Surface Storage	Supply	2	1093	72	0	-24	0	1141	76	1467	251	0	-28	111	1801
Alternative C No Surface Storage	Supply	3	1093	31	0	-29	0	1095	76	1467	121	0	-32	103	1660
Alternative C No Surface Storage	WQ	1	1093	88	0	-23	0	1158	76	1467	302	0	-26	123	1866
Alternative C No Surface Storage	WQ	3	1093	31	0	-29	0	1095	76	1467	121	0	-32	103	1660

Bay Area; Coast

Alternative Configuration		Delta Export Reduction Schedule	Bay Area: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Salt Load (1000 tons/year)	Coast: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Salt Load (tons/year)
Exist Cond.		N/A	323	0	0	0	5	328	109	0	0	0	0	0	0	
Exist Cond.		1	323	0	0	0	5	327	108.6	0	0	0	0	0	0	
No Action		N/A	324	0	0	0	3	327	107	54	0	0	0	0	54	
No Action		1	324	0	0	0	3	327	105.5	52	0	0	0	0	52	
BASE		N/A	322	0	0	0	5	327		47	0	0	0	0	47	
BASE		1	312	0	0	0	5	317		47	0	0	0	0	47	
Alternative A	Supply	1	312	-2	1	7	6	324	115	47	8	0	2	0	57	
Alternative A	Supply	2	312	-10	1	10	5	319	115	47	5	0	4	0	56	
Alternative A	Supply	3	312	-8	1	14	4	324	113	47	4	0	6	0	57	
Alternative A	WQ	1	312	-6	1	8	5	321	102	47	6	0	3	0	56	
Alternative A	WQ	3	312	-8	2	16	4	326	105	47	3	0	6	0	56	
Alternative B	Supply	1	312	15	2	4	5	337	114	47	17	1	2	0	66	
Alternative B	Supply	2	312	12	2	5	5	335	112	47	14	1	2	0	63	
Alternative B	Supply	3	312	5	3	9	5	333	108	47	9	1	4	0	60	
Alternative B	WQ	1	312	11	3	6	5	337	103	47	15	1	2	0	65	
Alternative B	WQ	3	312	5	3	9	4	334	104	47	8	1	4	0	59	
Alternative B No Surface	Supply	1	312	12	3	6	5	337		47	15	1	2	0	64	
Alternative B No Surface	Supply	2	312	5	3	7	4	331		47	11	1	3	0	62	
Alternative B No Surface	Supply	3	312	-11	5	13	4	323		47	6	1	5	0	58	
Alternative B No Surface	WQ	1	312	6	3	8	5	334		47	13	1	2	0	63	
Alternative B No Surface	WQ	3	312	-11	5	13	4	323		47	6	1	5	0	58	
Alternative C	Supply	1	312	5	1	4	5	327	114	47	8	0	1	0	56	
Alternative C	Supply	2	312	4	1	4	5	326	112	47	6	0	1	0	55	
Alternative C	Supply	3	312	-3	1	5	5	320	108	47	4	0	2	0	52	
Alternative C	Supply	1	312	4	1	4	5	326	113	47	7	0	1	0	56	
Alternative C	WQ	1	312	4	3	3	5	328	103	47	8	1	1	0	57	
Alternative C	WQ	3	312	-6	3	5	4	319	104	47	4	1	2	0	53	
Alternative C No Surface Storage	Supply	1	312	4	1	4	5	326		47	8	0	1	0	56	
Alternative C No Surface Storage	Supply	2	312	1	1	4	4	323		47	5	0	1	0	54	
Alternative C No Surface Storage	Supply	3	312	-7	1	5	4	316		47	3	0	2	0	52	
Alternative C No Surface Storage	WQ	1	312	4	1	4	5	326		47	7	0	1	0	55	
Alternative C No Surface Storage	WQ	3	312	-7	1	5	4	316		47	3	0	2	0	52	

South Coast

Alternative Configuration		Delta Export Reduction Schedule	Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Fixed Reliability Management Options	Salt Load @ Edmonston (1000 tons/year)
Exist Cond.		N/A	1294	0	0	0	0	1294		530
Exist Cond.		1	1266	0	0	0	0	1266		541.6
No Action		N/A	1677	0	0	0	24	1701		660
No Action		1	1631	0	0	0	19	1650		649.4
BASE		N/A	1399	0	0	0	0	1399		
BASE		1	1396	0	0	0	0	1396		
Alternative A	Supply	1	1396	259	6	69	0	1731		589
Alternative A	Supply	2	1396	169	12	124	0	1701		591
Alternative A	Supply	3	1396	124	12	171	0	1704		574
Alternative A	WQ	1	1396	190	9	101	0	1697		502
Alternative A	WQ	3	1396	82	13	180	0	1672		520
Alternative B	Supply	1	1396	480	18	56	35	1986		740
Alternative B	Supply	2	1396	359	19	69	32	1875		720
Alternative B	Supply	3	1396	241	27	117	29	1809		677
Alternative B	WQ	1	1396	395	21	67	34	1913		652
Alternative B	WQ	3	1396	213	28	114	26	1778		642
Alternative B No Surface	Supply	1	1396	436	22	67	31	1953		
Alternative B No Surface	Supply	2	1396	280	26	93	25	1821		
Alternative B No Surface	Supply	3	1396	157	38	153	25	1769		
Alternative B No Surface	WQ	1	1396	352	25	79	28	1880		
Alternative B No Surface	WQ	3	1396	157	38	153	25	1769		
Alternative C	Supply	1	1396	238	8	36	35	1714		739
Alternative C	Supply	2	1396	175	9	44	32	1657		720
Alternative C	Supply	3	1396	105	10	52	29	1593		677
Alternative C	Supply	1	1396	202	9	39	37	1683		728
Alternative C	WQ	1	1396	215	31	42	34	1718		652
Alternative C	WQ	3	1396	110	32	49	26	1612		642
Alternative C No Surface Storage	Supply	1	1396	214	9	39	31	1688		
Alternative C No Surface Storage	Supply	2	1396	144	10	46	25	1621		
Alternative C No Surface Storage	Supply	3	1396	77	11	54	25	1563		
Alternative C No Surface Storage	WQ	1	1396	178	10	44	28	1657		
Alternative C No Surface Storage	WQ	3	1396	77	11	54	25	1563		

Water Supply Allocation Summary
Dry & Critical Years

Alternative Configuration		Delta Export Reduction Schedule	Accounting Total of Delta Deliveries & Water Quality: Base Deliveries	Facility Benefit	Sacramento R. Basin (NOD) Transfer to Urban	Unused Facility Benefit	Interuptible	Total Bay Delta Deliveries	Total ERP Acquisitions (from willing sellers)	San Joaquin / Tulare (SOD) to Urban Reallocation	Tracy Ave Peak TDS (mg/l)	Banks Ave Peak TDS (mg/l)	Sacramento: ERP Acquisitions (from willing sellers)	Net Water Transfer	Water User Transfer Acq. (Total NOD Transfer Supply)	Number of Years Transfer Occurs
Exist Cond.		N/A	3800	0	0	0	127	3927	0	0	539	469		0		0
Exist Cond.		1	3676	0	0	0	109	3785	0	0	536	466		0		0
No Action		N/A	3883	0	0	0	63	3946	0	0	537	470		0		0
No Action		1	3735	0	0	0	63	3797	0	0	537	468		0		0
BASE		N/A	3799	0	0	0	127	3926	0	0				0		0
BASE		1	3677	0	0	0	109	3786	0	0				0		0
Alternative A	Supply	1	3677	298	19	0	136	4130	201	214	538	471	173	19	39	12
Alternative A	Supply	2	3677	163	23	0	108	3972	199	286	536	473	171	24	53	16
Alternative A	Supply	3	3677	122	24	0	89	3912	197	339	535	471	169	24	62	19
Alternative A	WQ	1	3677	159	24	0	125	3984	202	268	381	354	174	24	49	15
Alternative A	WQ	3	3677	33	25	0	85	3819	198	339	455	418	170	25	62	19
Alternative B	Supply	1	3677	580	47	0	113	4416	195	143	537	469	167	47	93	8
Alternative B	Supply	2	3677	442	46	0	94	4259	190	161	538	476	163	46	103	9
Alternative B	Supply	3	3677	290	58	0	79	4104	184	250	538	475	157	58	159	14
Alternative B	WQ	1	3677	489	58	0	104	4328	197	179	402	363	170	58	115	10
Alternative B	WQ	3	3677	258	64	0	69	4068	187	250	473	426	159	64	160	14
Alternative B No Surface Storage	Supply	1	3677	398	60	0	94	4229	201	179			173	60	115	10
Alternative B No Surface Storage	Supply	2	3677	234	67	0	74	4052	194	214			167	67	137	12
Alternative B No Surface Storage	Supply	3	3677	94	80	0	64	3915	190	286			163	80	183	16
Alternative B No Surface Storage	WQ	1	3677	274	66	0	87	4105	204	196			176	66	126	11
Alternative B No Surface Storage	WQ	3	3677	94	80	0	64	3915	190	286			163	80	183	16
Alternative C	Supply	1	3677	580	21	0	113	4391	195	100	538	469	167	21	46	14
Alternative C	Supply	2	3677	442	22	0	94	4234	190	100	538	476	163	22	46	14
Alternative C	Supply	3	3677	290	22	0	79	4069	184	121	537	475	157	23	56	17
Alternative C	Supply	1	3677	470	21	0	106	4274	198	93	538	469	171	21	42	13
Alternative C	WQ	1	3677	489	74	0	104	4344	197	100	402	363	170	74	160	14
Alternative C	WQ	3	3677	258	70	0	69	4076	187	114	473	426	159	72	184	16
Alternative C No Surface Storage	Supply	1	3677	398	26	0	94	4195	201	107			173	26	49	15
Alternative C No Surface Storage	Supply	2	3677	234	27	0	74	4012	194	121			167	27	56	17
Alternative C No Surface Storage	Supply	3	3677	94	26	0	64	3862	190	129			163	27	59	18
Alternative C No Surface Storage	WQ	1	3677	274	26	0	87	4065	204	107			176	26	49	15
Alternative C No Surface Storage	WQ	3	3677	94	26	0	64	3862	190	129			163	27	59	18

Alternative Configuration		Delta Export Reduction Schedule	San Joaquin: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer to Urban	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	ERP Acquisitions (from willing sellers)	Tulare: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer to Urban	Interuptible	Total Bay-Delta Supply (w/ Interruptible)
Exist Cond.		N/A	959	0	0	0	0	959		1276	0	0	0	123	1399
Exist Cond.		1	918	0	0	0	0	918		1213	0	0	0	106	1319
No Action		N/A	933	0	0	0	0	933		1228	0	0	0	43	1271
No Action		1	896	0	0	0	0	896		1157	0	0	0	43	1200
BASE		N/A	962	0	0	0	0	962		1214	0	0	0	123	1337
BASE		1	917	0	0	0	0	917		1152	0	0	0	106	1258
Alternative A	Supply	1	917	5	0	-102	0	820	28	1152	11	0	-103	132	1192
Alternative A	Supply	2	917	3	0	-133	0	788	28	1152	6	0	-141	105	1123
Alternative A	Supply	3	917	0	0	-156	0	762	28	1152	1	0	-172	87	1068
Alternative A	WQ	1	917	5	0	-126	0	796	28	1152	11	0	-132	121	1152
Alternative A	WQ	3	917	1	0	-156	0	762	28	1152	2	0	-174	83	1063
Alternative B	Supply	1	917	23	0	-70	0	870	28	1152	61	0	-72	81	1222
Alternative B	Supply	2	917	14	0	-79	0	852	28	1152	38	0	-82	67	1176
Alternative B	Supply	3	917	6	0	-117	0	807	28	1152	18	0	-131	58	1098
Alternative B	WQ	1	917	26	0	-89	0	854	28	1152	69	0	-89	75	1206
Alternative B	WQ	3	917	7	0	-118	0	806	28	1152	20	0	-125	50	1098
Alternative B No Surface Storage	Supply	1	917	13	0	-89	0	841	28	1152	35	0	-89	66	1164
Alternative B No Surface Storage	Supply	2	917	10	0	-105	0	823	28	1152	29	0	-109	53	1125
Alternative B No Surface Storage	Supply	3	917	3	0	-136	0	783	28	1152	8	0	-149	46	1057
Alternative B No Surface Storage	WQ	1	917	13	0	-98	0	833	28	1152	35	0	-99	62	1150
Alternative B No Surface Storage	WQ	3	917	3	0	-136	0	783	28	1152	8	0	-149	46	1057
Alternative C	Supply	1	917	101	0	-45	0	973	28	1152	265	0	-55	81	1444
Alternative C	Supply	2	917	78	0	-45	0	950	28	1152	202	0	-55	67	1367
Alternative C	Supply	3	917	51	0	-53	0	915	28	1152	131	0	-61	58	1280
Alternative C	Supply	1	917	83	0	-43	0	958	28	1152	219	0	-50	74	1395
Alternative C	WQ	1	917	85	0	-46	0	956	28	1152	224	0	-54	75	1397
Alternative C	WQ	3	917	44	1	-51	0	912	28	1152	116	1	-57	50	1263
Alternative C No Surface Storage	Supply	1	917	69	0	-49	0	938	28	1152	183	0	-58	66	1344
Alternative C No Surface Storage	Supply	2	917	42	0	-56	0	903	28	1152	111	0	-65	53	1252
Alternative C No Surface Storage	Supply	3	917	17	0	-58	0	877	28	1152	44	0	-64	46	1179
Alternative C No Surface Storage	WQ	1	917	49	0	-51	0	916	28	1152	131	0	-57	62	1288
Alternative C No Surface Storage	WQ	3	917	17	0	-58	0	877	28	1152	44	0	-64	46	1179

Alternative Configuration		Delta Export Reduction Schedule	Bay Area: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Salt Load (1000 tons/year)	Coast: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Salt Load (tons/year)	South Coast: Base Bay-Delta Supply	Facility Benefit	NOD Transfer Benefit	SOD Transfer Benefit	Interuptible	Total Bay-Delta Supply (w/ Interruptible)	Fixed Reliability Management Options	Salt Load @ Edmonston (1000 tons/year)
Exist Cond.		N/A	338	0	0	0	3	342	200	0	0	0	0	0	0		1227	0	0	0	0	1227		896
Exist Cond.		1	338	0	0	0	3	341	205	0	0	0	0	0	0		1208	0	0	0	0	1208		903.5
No Action		N/A	332	0	0	0	1	333	194.5	42	0	0	0	0	42		1348	0	0	0	18	1366		1060
No Action		1	334	0	0	0	2	336	192.7	41	0	0	0	0	41		1306	0	0	0	18	1325		1065
BASE		N/A	338	0	0	0	3	342		42	0	0	0	0	42		1243	0	0	0	0	1243		
BASE		1	333	0	0	0	3	336		41	0	0	0	0	41		1233	0	0	0	0	1233		
Alternative A	Supply	1	333	15	2	19	4	372	217	41	8	1	6	0	56		1233	259	17	181	0	1689		993
Alternative A	Supply	2	333	5	2	23	3	366	220	41	5	1	8	0	55		1233	143	20	243	0	1640		993
Alternative A	Supply	3	333	3	2	26	2	367	219	41	4	1	9	0	55		1233	113	21	292	0	1660		998
Alternative A	WQ	1	333	3	2	21	4	363	183	41	5	1	7	0	54		1233	135	21	230	0	1620		814
Alternative A	WQ	3	333	-4	3	29	2	362	203	41	1	1	9	0	53		1233	32	21	292	0	1579		843
Alternative B	Supply	1	333	25	4	10	3	375	202	41	16	1	4	0	62		1233	455	41	129	29	1888		1119
Alternative B	Supply	2	333	22	4	12	2	373	203	41	13	1	4	0	60		1233	355	41	144	24	1798		1090
Alternative B	Supply	3	333	14	6	19	2	374	193	41	9	2	7	0	58		1233	243	50	222	20	1767		1041
Alternative B	WQ	1	333	18	6	17	2	376	184	41	13	2	5	0	61		1233	362	51	157	27	1830		947
Alternative B	WQ	3	333	10	6	21	2	372	192	41	8	2	7	0	58		1233	213	56	215	17	1734		977
Alternative B No Surface Storage	Supply	1	333	16	7	16	2	374		41	11	2	5	0	59		1233	322	52	158	25	1790		
Alternative B No Surface Storage	Supply	2	333	1	7	17	2	359		41	7	2	6	0	56		1233	186	58	192	19	1688		
Alternative B No Surface Storage	Supply	3	333	-7	8	22	2	357		41	3	2	8	0	55		1233	87	70	255	17	1663		
Alternative B No Surface Storage	WQ	1	333	5	7	18	2	365		41	7	2	5	0	56		1233	214	57	173	23	1700		
Alternative B No Surface Storage	WQ	3	333	-7	8	22	2	357		41	3	2	8	0	55		1233	87	70	255	17	1663		
Alternative C	Supply	1	333	10	2	9	3	357	202	41	7	1	3	0	51		1233	196	19	88	29	1565		1119
Alternative C	Supply	2	333	9	2	9	2	355	203	41	5	1	3	0	50		1233	148	19	88	24	1512		1090
Alternative C	Supply	3	333	6	2	10	2	353	193	41	3	1	3	0	49		1233	100	19	101	20	1472		1041
Alternative C	Supply	1	333	8	2	9	3	354	205	41	5	1	3	0	50		1233	155	19	82	30	1518		1177
Alternative C	WQ	1	333	7	7	9	2	359	184	41	6	2	3	0	52		1233	167	65	88	27	1580		947
Alternative C	WQ	3	333	2	7	10	2	354	192	41	3	2	3	0	50		1233	93	62	94	17	1498		977
Alternative C No Surface Storage	Supply	1	333	5	2	10	2	353		41	5	1	3	0	50		1233	136	23	94	25	1511		
Alternative C No Surface Storage	Supply	2	333	1	3	10	2	349		41	3	1	3	0	48		1233	77	23	108	19	1460		
Alternative C No Surface Storage	Supply	3	333	-1	3	11	2	347		41	1	1	4	0	47		1233	32	23	107	17	1412		
Alternative C No Surface Storage	WQ	1	333	1	2	10	2	348		41	3	1	3	0	48		1233	90	23	94	23	1464		
Alternative C No Surface Storage	WQ	3	333	-1	3	11	2	347		41	1	1	4	0	47		1233	32	23	107	17	1412		

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
		Existing		No Action		Ex.NA.	BASE																										
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
		EXIST	EXIST_1	NA	NA_1	EXIST_NA	BASE	A_S_1	A_S_2	A_S_3	A_Q_1	A_Q_3	B_S_1	B_S_2	B_S_3	B_Q_1	B_Q_3	B_S_1_NSS	B_S_2_NSS	B_S_3_NSS	B_Q_1_NSS	B_Q_3_NSS	C_S_1	C_S_1_20	C_S_2	C_S_3	C_Q_1	C_Q_3	C_S_1_NSS	C_S_2_NSS	C_S_3_NSS	C_Q_1_NSS	C_Q_3_NSS
System Operations																																	
Surface Water (TAF/yr)																																	
1. Trinity Imports	DWRSIM	650	649	651	650	650	650	651	651	650	652	651	654	654	654	655	652	652	650	651	653	651	654	657	654	654	655	652	652	650	651	653	651
2. Unstored Inflow	DWRSIM	14,414	14,434	14,251	14,291	14,291	14,291	14,209	14,230	14,239	14,152	14,210	13,978	14,000	14,075	13,898	14,055	14,221	14,263	14,354	14,150	14,354	13,978	14,036	14,000	14,075	13,898	14,055	14,221	14,263	14,354	14,150	14,354
3. Stored Inflows																																	
Existing Storage	DWRSIM	3,016	2,993	3,119	3,076	3,076	3,076	3,151	3,125	3,115	3,212	3,146	2,962	2,939	2,871	3,037	2,877	3,136	3,090	2,987	3,208	2,987	2,962	3,035	2,939	2,871	3,037	2,877	3,136	3,090	2,987	3,208	2,987
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	21	21	20	21	21	22	25	29	26	29	24	25	38	25	38	22	23	25	29	26	29	24	25	38	25	38
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	365	360	345	374	357	0	0	0	0	0	365	258	360	345	374	357	0	0	0	0	0
4. Upstream Exports	DWRSIM	20	20	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
5. Sacramento Outflow																																	
Unstored	DWRSIM	12,375	12,392	12,176	12,216	12,216	12,216	12,140	12,162	12,173	12,083	12,144	11,912	11,937	12,012	11,831	11,983	12,148	12,190	12,280	12,079	12,280	11,912	11,980	11,937	12,012	11,831	11,983	12,148	12,190	12,280	12,079	12,280
Existing Storage	DWRSIM	2,955	2,932	3,030	2,987	2,987	2,987	3,061	3,033	3,024	3,123	3,054	2,866	2,841	2,773	2,942	2,782	3,047	3,000	2,896	3,119	2,896	2,866	2,934	2,841	2,773	2,942	2,782	3,047	3,000	2,896	3,119	2,896
New Storage	DWRSIM	0	0	0	0	0	0	22	22	21	22	22	387	386	374	400	386	25	26	39	26	39	387	281	386	374	400	386	25	26	39	26	39
Transfers for ERP	DWRSIM	0	0	0	0	0	0	201	199	197	205	199	199	196	192	204	193	203	199	189	206	189	199	194	196	192	204	193	203	199	189	206	189
Transfers for Water Users	Allocation Analysis	0	0	0	0	0	0	15	28	41	21	43	40	48	82	48	82	48	64	108	56	108	19	20	22	29	74	100	20	24	31	23	31
Reservoir Operations																																	
1. Carryover Storage																																	
Existing Storage	DWRSIM	5,326	5,392	5,150	5,225	5,225	5,225	5,063	5,116	5,121	4,943	5,086	5,409	5,468	5,588	5,335	5,606	5,135	5,217	5,416	5,030	5,416	5,409	5,254	5,468	5,588	5,335	5,606	5,135	5,217	5,416	5,030	5,416
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	1,408	1,449	1,509	1,380	1,493	0	0	0	0	0	1,408	1,139	1,449	1,509	1,380	1,493	0	0	0	0	0
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	451	454	461	451	458	451	446	440	439	438	445	443	427	443	427	451	448	446	440	439	438	445	443	427	443	427
2. Maximum Storage																																	
Existing Storage	DWRSIM	7,838	7,871	7,770	7,783	7,783	7,783	7,750	7,778	7,777	7,663	7,747	7,893	7,909	7,976	7,849	7,995	7,823	7,866	7,962	7,730	7,962	7,893	7,817	7,909	7,976	7,849	7,995	7,823	7,866	7,962	7,730	7,962
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	1,635	1,669	1,719	1,600	1,702	0	0	0	0	0	1,635	1,279	1,669	1,719	1,600	1,702	0	0	0	0	0
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	461	465	471	461	468	461	459	455	452	452	457	456	448	455	448	461	459	459	455	452	452	457	456	448	455	448
3. Shasta Levels																																	
No. of events below 1,900 TAF	DWRSIM	11	9	14	13	13	13	12	11	11	14	10	12	11	12	14	10	10	11	11	11	11	12	15	11	12	14	10	10	11	11	11	11
No. of events below 1,200 TAF	DWRSIM	6	6	7	6	6	6	7	6	7	8	7	7	7	7	7	7	7	6	7	7	7	7	7	7	7	7	7	7	6	7	7	7
Consumptive Use of Applied Water																																	
Upland Areas																																	
1. Refuge	Footnote 1. & 2.	24	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	B 160 / Hydrology	450	nc	510	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	151	nc	207	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater Basin																																	
1. Refuge	Footnote 1.	191	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hyd	4,381	nc	4,358	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hyd	384	nc	619	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region
Long-Term Average

Resource Mix	Data Source / Footnotes	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority		Existing Water Supply		No Action Water Supply		Ex.NA. BASE Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level		None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	213,542	212,326	nc	nc	nc	247,170	247,002	nc	nc	nc	246,799	nc	nc	nc	nc	nc	247,039	nc	nc	nc	nc	247,120	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	1,564,758	1,563,742	nc	nc	nc	1,563,243	1,563,805	nc	nc	nc	1,563,275	nc	nc	nc	nc	nc	1,564,068	nc	nc	nc	nc	1,563,775	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	0	-288	nc	nc	nc	-332	-313	nc	nc	nc	-378	nc	nc	nc	nc	nc	-293	nc	nc	nc	-298	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	0	429	nc	nc	nc	516	477	nc	nc	nc	604	nc	nc	nc	nc	nc	443	nc	nc	nc	465	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	617,846	617,987	nc	nc	nc	618,030	618,010	nc	nc	nc	618,072	nc	nc	nc	nc	nc	617,996	nc	nc	nc	618,013	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	1,610	1,592	nc	nc	nc	1,590	1,591	nc	nc	nc	1,587	nc	nc	nc	nc	nc	1,592	nc	nc	nc	nc	1,592	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	115	108	nc	nc	nc	108	108	nc	nc	nc	107	nc	nc	nc	nc	nc	108	nc	nc	nc	nc	108	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	82	81	nc	nc	nc	81	81	nc	nc	nc	81	nc	nc	nc	nc	nc	81	nc	nc	nc	nc	81	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	55	55	nc	nc	nc	55	55	nc	nc	nc	55	nc	nc	nc	nc	nc	55	nc	nc	nc	nc	55	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	166	165	nc	nc	nc	165	165	nc	nc	nc	165	nc	nc	nc	nc	nc	165	nc	nc	nc	nc	165	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	468	460	nc	nc	nc	459	459	nc	nc	nc	457	nc	nc	nc	nc	nc	460	nc	nc	nc	nc	460	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	69	69	nc	nc	nc	69	69	nc	nc	nc	69	nc	nc	nc	nc	nc	69	nc	nc	nc	nc	69	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	114	114	nc	nc	nc	114	114	nc	nc	nc	114	nc	nc	nc	nc	nc	114	nc	nc	nc	nc	114	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	320	320	nc	nc	nc	320	320	nc	nc	nc	320	nc	nc	nc	nc	nc	320	nc	nc	nc	nc	320	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	199	198	nc	nc	nc	198	198	nc	nc	nc	198	nc	nc	nc	nc	nc	198	nc	nc	nc	nc	198	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	8	8	nc	nc	nc	8	8	nc	nc	nc	8	nc	nc	nc	nc	nc	8	nc	nc	nc	nc	8	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	14	14	nc	nc	nc	14	14	nc	nc	nc	14	nc	nc	nc	nc	nc	14	nc	nc	nc	nc	14	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Analysis	0	0	0	0	0	0	12	23	33	17	35	9	11	19	11	19	11	15	25	13	25	15	16	18	23	17	23	16	19	25	18	25
Dry & Critical Years (28 Years)	Allocation Analysis	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	54	nc	nc	nc	55	55	nc	nc	nc	56	nc	nc	nc	nc	nc	54	nc	nc	nc	nc	54	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region
Long-Term Average

Resource Mix	Data	Base Conditions – Existing		Base Conditions – No Action		Base Conditions – Ex.NA. BASE		Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Groundwater																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM / CVPM	nc	nc	nc	nc	nc	3,767	nc	nc	nc	nc	3,771	3,765	nc	nc	nc	3,768	nc	nc	nc	nc	nc	3,761	nc	nc	nc	nc	3,765	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 1	CVGSM	nc	nc	nc	nc	nc	454	nc	nc	nc	nc	454	454	nc	nc	nc	454	nc	nc	nc	nc	nc	454	nc	nc	nc	nc	454	nc	nc	nc	nc	nc
CVGSM Subregion 2	CVGSM	nc	nc	nc	nc	nc	182	nc	nc	nc	nc	182	182	nc	nc	nc	182	nc	nc	nc	nc	nc	182	nc	nc	nc	nc	182	nc	nc	nc	nc	nc
CVGSM Subregion 3	CVGSM	nc	nc	nc	nc	nc	116	nc	nc	nc	nc	116	116	nc	nc	nc	259	nc	nc	nc	nc	nc	116	nc	nc	nc	nc	116	nc	nc	nc	nc	nc
CVGSM Subregion 4	CVGSM	nc	nc	nc	nc	nc	46	nc	nc	nc	nc	46	46	nc	nc	nc	46	nc	nc	nc	nc	nc	46	nc	nc	nc	nc	46	nc	nc	nc	nc	nc
CVGSM Subregion 5	CVGSM	nc	nc	nc	nc	nc	80	nc	nc	nc	nc	80	80	nc	nc	nc	80	nc	nc	nc	nc	nc	80	nc	nc	nc	nc	80	nc	nc	nc	nc	nc
CVGSM Subregion 6	CVGSM	nc	nc	nc	nc	nc	39	nc	nc	nc	nc	39	39	nc	nc	nc	39	nc	nc	nc	nc	nc	39	nc	nc	nc	nc	39	nc	nc	nc	nc	nc
CVGSM Subregion 7	CVGSM	nc	nc	nc	nc	nc	-22	nc	nc	nc	nc	-22	-22	nc	nc	nc	-22	nc	nc	nc	nc	nc	-22	nc	nc	nc	nc	-22	nc	nc	nc	nc	nc
CVGSM Subregion 8	CVGSM	nc	nc	nc	nc	nc	8	nc	nc	nc	nc	8	8	nc	nc	nc	8	nc	nc	nc	nc	nc	8	nc	nc	nc	nc	8	nc	nc	nc	nc	nc
CVGSM Subregion 9	CVGSM	nc	nc	nc	nc	nc	19	nc	nc	nc	nc	18	19	nc	nc	nc	18	nc	nc	nc	nc	nc	19	nc	nc	nc	nc	19	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-3	nc	nc	nc	nc	-3	-4	nc	nc	nc	-3	nc	nc	nc	nc	nc	-3	nc	nc	nc	nc	-3	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	165	nc	nc	nc	nc	165	165	nc	nc	nc	165	nc	nc	nc	nc	nc	165	nc	nc	nc	nc	165	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	2,463	nc	nc	nc	nc	2,463	2,463	nc	nc	nc	2,463	nc	nc	nc	nc	nc	2,463	nc	nc	nc	nc	2,463	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	815	nc	nc	nc	nc	817	814	nc	nc	nc	816	nc	nc	nc	nc	nc	812	nc	nc	nc	nc	814	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping																																	
South Sacramento Co.	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs																																	
South Sacramento Co.	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region
Long-Term Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Tulare Basin (James Bypass) Inflow	DWRSIM	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205
2. Unstored Inflow	DWRSIM	4,342	4,340	4,347	4,346	4,346	4,346	4,347	4,346	4,346	4,347	4,346	4,347	4,346	4,346	4,347	4,346	4,347	4,346	4,346	4,347	4,346	4,347	4,347	4,346	4,346	4,347	4,346	4,347	4,346	4,346	4,347	4,346
3. Stored Inflows																																	
Existing Storage	DWRSIM	943	944	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980
New Groundwater Storage	Footnote 4.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Total Delta Import Deliveries																																	
Base Bay-Delta Supply	Allocation Analysis	1,140	1,096	1,131	1,085	1,142	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093	1,093
New Facility Benefit	Allocation Analysis	0	0	0	0	0	0	14	7	4	13	5	52	38	17	58	18	46	38	15	49	15	113	102	87	51	103	45	99	72	31	88	31
Transfers to Urban	Allocation Analysis	0	0	0	0	0	0	-39	-68	-92	-54	-97	-30	-36	-60	-37	-60	-37	-49	-79	-43	-79	-19	-20	-22	-28	-21	-27	-20	-24	-29	-23	-29
Transfers in from NOD	Allocation Analysis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Interruptible	Allocation Analysis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Bay-Delta Supply	Allocation Analysis	1,140	1,096	1,131	1,085	1,142	1,093	1,067	1,033	1,006	1,052	1,001	1,115	1,095	1,050	1,114	1,051	1,102	1,081	1,029	1,098	1,029	1,188	1,175	1,157	1,117	1,175	1,112	1,172	1,141	1,095	1,158	1,095
5. Upstream Exports																																	
Friant-Kern	DWRSIM	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Hetch-Hetchy	Footnote 5.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. San Joaquin Outflow	DWRSIM	2,683	2,678	2,727	2,723	2,723	2,723	2,803	2,800	2,800	2,801	2,799	2,800	2,799	2,796	2,799	2,796	2,801	2,799	2,798	2,801	2,798	2,800	2,799	2,799	2,796	2,799	2,796	2,801	2,799	2,798	2,801	2,798
Unstored	DWRSIM	2,081	2,076	2,087	2,086	2,086	2,086	2,087	2,086	2,086	2,086	2,085	2,086	2,085	2,083	2,085	2,083	2,087	2,085	2,085	2,086	2,085	2,086	2,085	2,085	2,083	2,085	2,083	2,087	2,085	2,085	2,086	2,085
Existing Storage	DWRSIM	524	523	561	560	560	560	561	560	560	560	559	560	559	558	559	558	560	559	559	560	559	560	559	559	558	559	558	560	559	559	560	559
Transfers (ERPP)	DWRSIM	0	0	0	0	0	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Reservoir Operations																																	
1. Carryover Storage	DWRSIM	3,394	3,401	3,379	3,378	3,378	3,378	3,379	3,379	3,379	3,379	3,379	3,379	3,378	3,377	3,378	3,377	3,379	3,378	3,378	3,379	3,378	3,379	3,378	3,378	3,377	3,378	3,377	3,379	3,378	3,378	3,379	3,378
Existing Storage	Footnote 6.																																
New Groundwater Storage	Footnote 4.																																
2. Maximum Storage	DWRSIM	4,504	4,511	4,477	4,476	4,476	4,476	4,477	4,477	4,477	4,477	4,477	4,476	4,476	4,475	4,476	4,476	4,477	4,476	4,476	4,477	4,476	4,476	4,476	4,476	4,475	4,476	4,476	4,477	4,476	4,476	4,477	4,476
Existing Storage	Footnote 6.																																
New Groundwater Storage	Footnote 4.																																
Consumptive Use of Applied Water																																	
Upland Areas																																	
1. Refuge	Footnote 2.																																
2. Ag.	B 160 / Hydrology	13	nc	17	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	27	nc	48	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater Basin																																	
1. Refuge	Footnote 1.	279	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hydr	3,113	nc	2,880	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hydr	156	nc	264	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Source /	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority		Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	389,186	388,972	nc	nc	nc	388,490	388,910	nc	nc	nc	388,923	nc	nc	nc	nc	nc	388,701	nc	nc	nc	nc	388,924	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	1,564,758	1,563,742	nc	nc	nc	1,563,243	1,563,805	nc	nc	nc	1,563,275	nc	nc	nc	nc	nc	1,564,068	nc	nc	nc	nc	1,563,775	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	0	-109	nc	nc	nc	-238	-107	nc	nc	nc	-145	nc	nc	nc	nc	nc	-122	nc	nc	nc	-110	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	0	124	nc	nc	nc	215	111	nc	nc	nc	153	nc	nc	nc	nc	nc	105	nc	nc	nc	114	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	2,177,191	2,177,205	nc	nc	nc	2,177,167	2,177,194	nc	nc	nc	2,177,198	nc	nc	nc	nc	nc	2,177,173	nc	nc	nc	2,177,194	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	1,624	1,618	nc	nc	nc	1,611	1,618	nc	nc	nc	1,616	nc	nc	nc	nc	nc	1,618	nc	nc	nc	nc	1,618	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	163	160	nc	nc	nc	158	161	nc	nc	nc	160	nc	nc	nc	nc	nc	161	nc	nc	nc	nc	160	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	122	121	nc	nc	nc	120	121	nc	nc	nc	121	nc	nc	nc	nc	nc	121	nc	nc	nc	nc	121	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	32	32	nc	nc	nc	32	32	nc	nc	nc	32	nc	nc	nc	nc	nc	32	nc	nc	nc	nc	32	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	205	204	nc	nc	nc	203	204	nc	nc	nc	204	nc	nc	nc	nc	nc	204	nc	nc	nc	nc	204	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	16	16	nc	nc	nc	16	16	nc	nc	nc	16	nc	nc	nc	nc	nc	16	nc	nc	nc	nc	16	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	157	157	nc	nc	nc	157	157	nc	nc	nc	157	nc	nc	nc	nc	nc	157	nc	nc	nc	nc	157	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	61	61	nc	nc	nc	61	61	nc	nc	nc	61	nc	nc	nc	nc	nc	61	nc	nc	nc	nc	61	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	393	393	nc	nc	nc	393	393	nc	nc	nc	393	nc	nc	nc	nc	nc	393	nc	nc	nc	nc	393	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	102	102	nc	nc	nc	102	102	nc	nc	nc	102	nc	nc	nc	nc	nc	102	nc	nc	nc	nc	102	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	183	183	nc	nc	nc	183	183	nc	nc	nc	183	nc	nc	nc	nc	nc	183	nc	nc	nc	nc	183	nc	nc	nc	nc	nc
Cotton	CVPM	nc	nc	nc	nc	nc	177	176	nc	nc	nc	175	176	nc	nc	nc	176	nc	nc	nc	nc	nc	176	nc	nc	nc	nc	176	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	11	11	nc	nc	nc	11	11	nc	nc	nc	11	nc	nc	nc	nc	nc	11	nc	nc	nc	nc	11	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Process	0	0	0	0	0	0	12	23	33	17	35	9	11	19	11	19	11	15	25	13	25	15	16	18	23	17	23	16	19	25	18	25
Dry & Critical Years (28 Years)	Allocation Process	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	47	nc	nc	nc	48	47	nc	nc	nc	47	nc	nc	nc	nc	nc	48	nc	nc	nc	nc	47	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region
Long-Term Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Groundwater																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM/CVPM	nc	nc	nc	nc	nc	1,608	nc	nc	nc	nc	1,681	1,593	nc	nc	nc	1,641	nc	nc	nc	nc	nc	1,552	nc	nc	nc	nc	1,599	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 10	CVGSM	nc	nc	nc	nc	nc	102	nc	nc	nc	nc	97	104	nc	nc	nc	100	nc	nc	nc	nc	nc	107	nc	nc	nc	nc	103	nc	nc	nc	nc	nc
CVGSM Subregion 11	CVGSM	nc	nc	nc	nc	nc	51	nc	nc	nc	nc	51	51	nc	nc	nc	51	nc	nc	nc	nc	nc	51	nc	nc	nc	nc	51	nc	nc	nc	nc	nc
CVGSM Subregion 12	CVGSM	nc	nc	nc	nc	nc	68	nc	nc	nc	nc	67	68	nc	nc	nc	68	nc	nc	nc	nc	nc	68	nc	nc	nc	nc	68	nc	nc	nc	nc	nc
CVGSM Subregion 13	CVGSM	nc	nc	nc	nc	nc	90	nc	nc	nc	nc	86	93	nc	nc	nc	88	nc	nc	nc	nc	nc	96	nc	nc	nc	nc	91	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-38	nc	nc	nc	nc	-46	-29	nc	nc	nc	-39	nc	nc	nc	nc	nc	-24	nc	nc	nc	nc	-32	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	75	nc	nc	nc	nc	75	75	nc	nc	nc	75	nc	nc	nc	nc	nc	75	nc	nc	nc	nc	75	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	947	nc	nc	nc	nc	947	948	nc	nc	nc	947	nc	nc	nc	nc	nc	948	nc	nc	nc	nc	948	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	339	nc	nc	nc	nc	407	315	nc	nc	nc	368	nc	nc	nc	nc	nc	272	nc	nc	nc	nc	327	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Source /	Existing		No Action		Ex.NA. BASE																											
Operational Priority		Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Friant-Kern Imports	DWRSIM	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098	1,098
2. Unstored Inflow	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Stored Inflows	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Total Delta Import Deliveries																																	
Base Bay-Delta Supply	Allocation Process	1,697	1,623	1,712	1,616	1,551	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467
New Facility Benefit	Allocation Process	0	0	0	0	0	0	46	25	14	46	17	186	143	65	204	70	171	144	60	179	60	371	338	289	176	342	159	334	251	121	302	121
Transfers to Urban	Allocation Process	0	0	0	0	0	0	-39	-71	-99	-58	-105	-32	-39	-69	-38	-67	-38	-53	-92	-46	-92	-23	-24	-27	-32	-25	-29	-24	-28	-32	-26	-32
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Interruptible	Allocation Process	199	166	103	76	199	166	219	186	157	207	156	152	139	129	144	119	132	111	103	123	103	152	146	139	129	144	119	132	111	103	123	103
Net Bay-Delta Supply	Allocation Process	1,896	1,788	1,816	1,693	1,749	1,633	1,693	1,608	1,540	1,662	1,534	1,774	1,710	1,592	1,777	1,589	1,732	1,669	1,538	1,723	1,538	1,967	1,927	1,869	1,740	1,928	1,718	1,910	1,801	1,660	1,866	1,660
5. Upstream Exports	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
6. Tulare Outflow																																	
James Bypass	DWRSIM	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204	204
Consumptive Use of Applied Water																																	
Upland Areas																																	
1. Refuge	Footnote 2.																																
2. Ag.	Footnote 8.																																
3. Urban	Footnote 8.																																
Groundwater Basin																																	
1. Refuge	Footnote 1.	13	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hydi	6,835	nc	6,349	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hydi	273	nc	526	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Source /	Existing Water Supply		No Action Water Supply		Ex.NA. BASE Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	865,453	865,975	nc	nc	nc	865,917	866,320	nc	nc	nc	865,921	nc	nc	nc	nc	nc	866,783	nc	nc	nc	nc	866,146	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	1,564,758	1,563,742	nc	nc	nc	1,563,243	1,563,805	nc	nc	nc	1,563,275	nc	nc	nc	nc	nc	1,564,068	nc	nc	nc	nc	1,563,775	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	0	13	nc	nc	nc	-86	102	nc	nc	nc	-35	nc	nc	nc	nc	nc	219	nc	nc	nc	57	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	0	89	nc	nc	nc	283	64	nc	nc	nc	168	nc	nc	nc	nc	nc	53	nc	nc	nc	70	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	523,376	523,478	nc	nc	nc	523,573	523,542	nc	nc	nc	523,508	nc	nc	nc	nc	nc	523,648	nc	nc	nc	523,502	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	2,904	2,905	nc	nc	nc	2,900	2,909	nc	nc	nc	2,902	nc	nc	nc	nc	nc	2,915	nc	nc	nc	nc	2,907	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	18	18	nc	nc	nc	18	18	nc	nc	nc	18	nc	nc	nc	nc	nc	18	nc	nc	nc	nc	18	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	236	236	nc	nc	nc	235	237	nc	nc	nc	236	nc	nc	nc	nc	nc	238	nc	nc	nc	nc	237	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	25	25	nc	nc	nc	25	25	nc	nc	nc	25	nc	nc	nc	nc	nc	25	nc	nc	nc	nc	25	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	225	225	nc	nc	nc	225	225	nc	nc	nc	225	nc	nc	nc	nc	nc	226	nc	nc	nc	nc	225	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	0	0	nc	nc	nc	0	0	nc	nc	nc	0	nc	nc	nc	nc	nc	0	nc	nc	nc	nc	0	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	350	350	nc	nc	nc	350	350	nc	nc	nc	350	nc	nc	nc	nc	nc	350	nc	nc	nc	nc	350	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	84	84	nc	nc	nc	84	84	nc	nc	nc	84	nc	nc	nc	nc	nc	85	nc	nc	nc	nc	84	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	349	349	nc	nc	nc	349	349	nc	nc	nc	349	nc	nc	nc	nc	nc	349	nc	nc	nc	nc	349	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	145	145	nc	nc	nc	144	145	nc	nc	nc	144	nc	nc	nc	nc	nc	145	nc	nc	nc	nc	145	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	363	363	nc	nc	nc	363	363	nc	nc	nc	363	nc	nc	nc	nc	nc	363	nc	nc	nc	nc	363	nc	nc	nc	nc	nc
Cotton	CVPM	nc	nc	nc	nc	nc	921	922	nc	nc	nc	918	924	nc	nc	nc	920	nc	nc	nc	nc	nc	928	nc	nc	nc	nc	923	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	188	188	nc	nc	nc	188	188	nc	nc	nc	188	nc	nc	nc	nc	nc	188	nc	nc	nc	nc	188	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Process	0	0	0	0	0	0	12	23	33	17	35	9	11	19	11	19	11	15	25	13	25	15	16	18	23	17	23	16	19	25	18	25
Dry & Critical Years (28 Years)	Allocation Process	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	102	nc	nc	nc	104	101	nc	nc	nc	103	nc	nc	nc	nc	nc	99	nc	nc	nc	nc	101	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region
Long-Term Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Data Source / Footnotes	Existing Water Supply		No Action Water Supply		Ex.NA. BASE Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level		None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Groundwater																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM / CVPM	nc	nc	nc	nc	nc	5,723	nc	nc	nc	nc	5,811	5,591	nc	nc	nc	5,761	nc	nc	nc	nc	nc	5,440	nc	nc	nc	nc	5,649	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 14	CVGSM	nc	nc	nc	nc	nc	156	nc	nc	nc	nc	144	175	nc	nc	nc	152	nc	nc	nc	nc	nc	196	nc	nc	nc	nc	166	nc	nc	nc	nc	nc
CVGSM Subregion 15	CVGSM	nc	nc	nc	nc	nc	47	nc	nc	nc	nc	40	56	nc	nc	nc	44	nc	nc	nc	nc	nc	67	nc	nc	nc	nc	52	nc	nc	nc	nc	nc
CVGSM Subregion 16	CVGSM	nc	nc	nc	nc	nc	128	nc	nc	nc	nc	126	131	nc	nc	nc	127	nc	nc	nc	nc	nc	135	nc	nc	nc	nc	129	nc	nc	nc	nc	nc
CVGSM Subregion 17	CVGSM	nc	nc	nc	nc	nc	192	nc	nc	nc	nc	192	192	nc	nc	nc	192	nc	nc	nc	nc	nc	192	nc	nc	nc	nc	192	nc	nc	nc	nc	nc
CVGSM Subregion 18	CVGSM	nc	nc	nc	nc	nc	221	nc	nc	nc	nc	220	222	nc	nc	nc	220	nc	nc	nc	nc	nc	223	nc	nc	nc	nc	221	nc	nc	nc	nc	nc
CVGSM Subregion 19	CVGSM	nc	nc	nc	nc	nc	306	nc	nc	nc	nc	298	313	nc	nc	nc	301	nc	nc	nc	nc	nc	321	nc	nc	nc	nc	309	nc	nc	nc	nc	nc
CVGSM Subregion 20	CVGSM	nc	nc	nc	nc	nc	236	nc	nc	nc	nc	231	241	nc	nc	nc	233	nc	nc	nc	nc	nc	246	nc	nc	nc	nc	238	nc	nc	nc	nc	nc
CVGSM Subregion 21	CVGSM	nc	nc	nc	nc	nc	388	nc	nc	nc	nc	381	392	nc	nc	nc	384	nc	nc	nc	nc	nc	399	nc	nc	nc	nc	390	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-302	nc	nc	nc	nc	-340	-249	nc	nc	nc	-313	nc	nc	nc	nc	nc	-195	nc	nc	nc	nc	-269	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	67	nc	nc	nc	nc	66	67	nc	nc	nc	67	nc	nc	nc	nc	nc	67	nc	nc	nc	nc	67	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	2,442	nc	nc	nc	nc	2,441	2,443	nc	nc	nc	2,442	nc	nc	nc	nc	nc	2,444	nc	nc	nc	nc	2,443	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	1,006	nc	nc	nc	nc	1,050	957	nc	nc	nc	1,027	nc	nc	nc	nc	nc	899	nc	nc	nc	nc	981	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Delta Region
Long-Term Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Delta Inflow (Sacramento River)																																	
Unstored	DWRSIM	12,375	12,392	12,176	12,216	12,216	12,216	12,140	12,162	12,173	12,083	12,144	11,912	11,937	12,012	11,831	11,983	12,148	12,190	12,280	12,079	12,280	11,912	11,980	11,937	12,012	11,831	11,983	12,148	12,190	12,280	12,079	12,280
Existing Storage	DWRSIM	2,955	2,932	3,030	2,987	2,987	2,987	3,061	3,033	3,024	3,123	3,054	2,866	2,841	2,773	2,942	2,782	3,047	3,000	2,896	3,119	2,896	2,866	2,934	2,841	2,773	2,942	2,782	3,047	3,000	2,896	3,119	2,896
New Storage	DWRSIM	0	0	0	0	0	0	22	22	21	22	22	387	386	374	400	386	25	26	39	26	39	387	281	386	374	400	386	25	26	39	26	39
Transfers	Allocation Process	0	0	0	0	0	0	15	28	41	21	43	40	48	82	48	82	48	64	108	56	108	19	20	22	29	74	100	20	24	31	23	31
2. Delta Inflow (San Joaquin River)																																	
Unstored	Allocation Process	2,081	2,076	2,087	2,086	2,086	2,086	2,087	2,086	2,086	2,086	2,085	2,086	2,085	2,083	2,085	2,083	2,087	2,085	2,085	2,086	2,085	2,086	2,085	2,085	2,083	2,085	2,083	2,087	2,085	2,085	2,086	2,085
Existing Storage	DWRSIM	524	523	561	560	560	560	561	560	560	560	559	560	559	558	559	558	560	559	559	560	559	560	559	559	558	559	558	560	559	559	560	559
3. Delta Exports																																	
Exports from Unstored Inflow	DWRSIM	3,314	3,154	3,580	3,379	3,379	3,379	3,356	3,226	3,156	3,257	3,097	3,628	3,448	3,287	3,506	3,235	3,692	3,508	3,354	3,569	3,354	3,628	3,605	3,448	3,287	3,506	3,235	3,692	3,508	3,354	3,569	3,354
Exports from Stored Inflow	DWRSIM	2,410	2,388	2,495	2,453	2,453	2,453	2,572	2,543	2,528	2,585	2,542	2,727	2,703	2,613	2,777	2,630	2,561	2,514	2,417	2,597	2,417	2,727	2,664	2,703	2,613	2,777	2,630	2,561	2,514	2,417	2,597	2,417
4. Delta Export Deliveries																																	
Base Deliveries	Allocation Process	4,454	4,307	4,899	4,709	4,460	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315	4,315
New Facility Benefit	Allocation Process	0	0	0	0	0	0	325	197	139	250	98	751	566	336	683	314	680	478	226	598	226	735	653	561	332	671	312	659	473	224	579	224
Interruptible	Allocation Process	204	171	130	98	204	171	225	190	161	212	160	193	176	162	183	149	167	140	132	155	132	193	188	176	162	183	149	167	140	132	155	132
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	7	14	15	11	16	20	21	30	25	32	25	30	44	29	44	9	10	11	12	35	38	11	11	13	12	13
Unused Facility Benefit	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-2	-1	-1	-2	-2	-1	-1	-1	-1	-1	-1	-2	-1	-1	-2	-2
Forecast Delivery Shortages (taf)	DWRSIM	18	17	24	40	40	40	41	82	122	46	117	56	90	82	57	86	63	94	77	64	77	56	46	90	82	57	86	63	94	77	64	77
Number of Forecast Shortages	DWRSIM	20	23	31	35	35	35	27	36	43	30	45	32	39	39	30	41	34	40	37	35	37	32	29	39	39	30	41	34	40	37	35	37
Max. Forecast Shortages (taf)	DWRSIM	219	236	276	421	421	421	265	529	662	336	598	591	529	484	549	499	407	467	567	407	567	591	485	529	484	549	499	407	467	567	407	567
5. Net Delta Outflow	DWRSIM	14,571	14,743	14,224	14,459	14,459	14,459	14,647	14,796	14,879	14,740	14,928	14,162	14,360	14,596	14,245	14,630	14,321	14,540	14,778	14,413	14,778	14,162	14,271	14,360	14,596	14,245	14,630	14,321	14,540	14,778	14,413	14,778
Outflow from Unstored Inflow	DWRSIM	13,766	13,939	13,406	13,643	13,643	13,643	13,854	14,004	14,082	13,901	14,114	13,360	13,561	13,790	13,405	13,818	13,531	13,750	13,982	13,587	13,982	13,360	13,451	13,561	13,790	13,405	13,818	13,531	13,750	13,982	13,587	13,982
Outflow from Storaged Inflow	DWRSIM	805	804	818	816	816	816	793	793	797	840	814	802	799	807	840	811	790	790	795	826	795	802	819	799	807	840	811	790	790	795	826	795
Outlfow from ERP Flows (Transfers)	DWRSIM	0	0	0	0	0	0	277	275	273	281	275	275	273	268	280	270	279	275	265	282	265	275	270	273	268	280	270	279	275	265	282	265
Outflow from Transfer Loss	Allocation Process	0	0	0	0	0	0	8	15	26	11	27	19	27	52	23	50	23	34	64	27	64	10	10	12	17	39	62	9	12	18	11	18
6. Mean X2 Position	DWRSIM	76	76	76	76	76	76	76	76	76	75	75	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
7. Mean Qwest	DWRSIM	70	84	45	64	64	64	57	69	76	64	80	22	38	57	28	60	31	49	68	38	68	22	27	38	57	28	60	31	49	68	38	68
8. Delta Cross Flow	DWRSIM	3,492	3,488	3,482	3,475	3,475	3,475	3,512	3,503	3,504	3,519	3,505	3,516	3,505	3,493	3,523	3,488	3,519	3,508	3,496	3,522	3,496	3,516	3,494	3,505	3,493	3,523	3,488	3,519	3,508	3,496	3,522	3,496

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Delta Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
		Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
<u>Water Quality</u>																																	
Salt Load (1000 Tons/yr)																																	
1. Clifton Court	DSM2	945	955	1,056	1,043	nc	nc	1,113	1,102	1,057	973	981	1,284	1,253	1,167	1,149	1,118	nc	nc	nc	nc	nc	1,283	1,258	1,253	1,166	1,149	1,118	nc	nc	nc	nc	nc
2. Tracy	DSM2	868	858	876	872	nc	nc	860	850	834	722	750	874	881	830	746	780	nc	nc	nc	nc	nc	874	872	881	830	746	780	nc	nc	nc	nc	nc
3. Rock Slough	DSM2	50	50	51	51	nc	nc	51	51	51	44	47	52	52	51	46	49	nc	nc	nc	nc	nc	52	52	52	51	46	49	nc	nc	nc	nc	nc
4. North Bay	DSM2	7	7	9	9	nc	nc	8	8	7	8	7	10	9	9	10	9	nc	nc	nc	nc	nc	10	9	9	9	10	9	nc	nc	nc	nc	nc
Salinity (ppm)																																	
1. Clifton Court	DSM2	261	261	264	264	nc	nc	267	267	264	237	247	267	266	263	240	251	nc	nc	nc	nc	nc	266	267	266	262	240	251	nc	nc	nc	nc	nc
2. Tracy	DSM2	282	282	286	285	nc	nc	290	290	286	252	264	291	290	285	257	271	nc	nc	nc	nc	nc	290	291	290	285	257	271	nc	nc	nc	nc	nc
3. Rock Slough	DSM2	250	251	254	253	nc	nc	258	258	255	222	234	258	258	253	227	240	nc	nc	nc	nc	nc	258	259	258	253	227	240	nc	nc	nc	nc	nc
4. North Bay	DSM2	143	142	143	142	nc	nc	142	141	141	142	141	140	140	140	140	140	nc	nc	nc	nc	nc	140	140	139	140	140	140	nc	nc	nc	nc	nc
5. Emmaton	DSM2	427	426	437	434	nc	nc	448	446	440	351	385	433	432	424	349	389	nc	nc	nc	nc	nc	433	437	432	424	349	389	nc	nc	nc	nc	nc
6. Jersey Point	DSM2	389	389	396	395	nc	nc	407	406	398	318	347	408	405	396	330	362	nc	nc	nc	nc	nc	408	409	405	396	330	362	nc	nc	nc	nc	nc
<u>Consumptive Use of Applied Water</u>																																	
1. Refuge	Footnote 9.																																
2. Ag.	B 160 / Hydrology	1,052	nc	1,031	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	48	nc	70	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
<u>Economic/Land Use</u>	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	61,498	61,590	nc	nc	nc	61,667	61,574	nc	nc	nc	61,632	nc	nc	nc	nc	nc	61,545	nc	nc	nc	nc	61,585	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	1,564,758	1,563,742	nc	nc	nc	1,563,243	1,563,805	nc	nc	nc	1,563,275	nc	nc	nc	nc	nc	1,564,068	nc	nc	nc	nc	1,563,775	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	0	1	nc	nc	nc	1	2	nc	nc	nc	2	nc	nc	nc	nc	nc	3	nc	nc	nc	2	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	0	0	nc	nc	nc	0	0	nc	nc	nc	0	nc	nc	nc	nc	nc	0	nc	nc	nc	0	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	1,628,724	1,628,726	nc	nc	nc	1,628,726	1,628,727	nc	nc	nc	1,628,726	nc	nc	nc	nc	nc	1,628,727	nc	nc	nc	1,628,727	nc	nc	nc	nc	nc	nc
Total Region Land Use																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	425	425	nc	nc	nc	425	425	nc	nc	nc	425	nc	nc	nc	nc	nc	425	nc	nc	nc	nc	425	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	24	25	nc	nc	nc	25	25	nc	nc	nc	25	nc	nc	nc	nc	nc	25	nc	nc	nc	nc	25	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	44	44	nc	nc	nc	44	44	nc	nc	nc	44	nc	nc	nc	nc	nc	44	nc	nc	nc	nc	44	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	29	29	nc	nc	nc	29	29	nc	nc	nc	29	nc	nc	nc	nc	nc	29	nc	nc	nc	nc	29	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	115	115	nc	nc	nc	115	115	nc	nc	nc	115	nc	nc	nc	nc	nc	115	nc	nc	nc	nc	115	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	1	1	nc	nc	nc	1	1	nc	nc	nc	1	nc	nc	nc	nc	nc	1	nc	nc	nc	nc	1	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	46	46	nc	nc	nc	46	46	nc	nc	nc	46	nc	nc	nc	nc	nc	46	nc	nc	nc	nc	46	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	42	42	nc	nc	nc	42	42	nc	nc	nc	42	nc	nc	nc	nc	nc	42	nc	nc	nc	nc	42	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	21	21	nc	nc	nc	21	21	nc	nc	nc	21	nc	nc	nc	nc	nc	21	nc	nc	nc	nc	21	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	97	97	nc	nc	nc	97	97	nc	nc	nc	97	nc	nc	nc	nc	nc	97	nc	nc	nc	nc	97	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	6	6	nc	nc	nc	6	6	nc	nc	nc	6	nc	nc	nc	nc	nc	6	nc	nc	nc	nc	6	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Francisco Bay Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
		Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water & Groundwater (TAF/yr)																																	
1. Hetch-Hetchy & Mokelumne Imports	LCPSIM / Footnote 10.	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505	505
2. Delta Imports																																	
Base Bay-Delta Supply	Allocation Process	323	323	324	324	322	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Facility Benefit	Allocation Process	0	0	0	0	0	0	-2	-10	-8	-6	-8	15	12	5	11	5	12	5	-11	6	-11	5	4	4	-3	4	-6	4	1	-7	4	-7
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	1	1	1	1	2	2	2	3	3	3	3	3	5	3	5	1	1	1	1	3	3	1	1	1	1	1
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	7	10	14	8	16	4	5	9	6	9	6	7	13	8	13	4	4	4	5	3	5	4	4	5	4	5
Interruptible	Allocation Process	5	5	3	3	5	5	6	5	4	5	4	5	5	5	5	4	5	4	4	5	4	5	5	5	5	5	4	5	4	4	5	4
Net Bay-Delta Supply	Allocation Process	328	327	327	327	327	317	324	319	324	321	326	337	335	333	337	334	337	331	323	334	323	327	326	326	320	328	319	326	323	316	326	316
Fixed Supply	LCPSIM / Footnote 11.	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449	449
3. Regional Option Use	LCPSIM	10	10	0	0	11	19	0	15	23	17	0	15	22	0	15	0	0	15	19	16	19	0	0	0	0	0	0	0	0	0	0	0
Recycling	LCPSIM	10	10	0	0	11	19	0	15	20	17	0	15	20	0	15	0	0	15	19	16	19	0	0	0	0	0	0	0	0	0	0	0
Conservation/Re-Use	LCPSIM	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater	LCPSIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ocean Water Desalting	LCPSIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Quality																																	
Salt Load (1000 Tons/yr)																																	
1. Rock Slough	DSM2	50	50	51	51	nc	nc	51	51	51	44	47	52	52	51	46	49	nc	nc	nc	nc	nc	52	52	52	51	46	49	nc	nc	nc	nc	nc
2. North Bay	DSM2	7	7	9	9	nc	nc	8	8	7	8	7	10	9	9	10	9	nc	nc	nc	nc	nc	10	9	9	9	10	9	nc	nc	nc	nc	nc
3. South Bay	DSM2	52	51	47	46	nc	nc	57	57	55	50	51	52	51	48	47	46	nc	nc	nc	nc	nc	52	51	51	48	47	46	nc	nc	nc	nc	nc
4. Mokelumne	East Bay MUD	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
5. Hetch-Hetchy	Footnote 12.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. Local Supplies	Footnote 13.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Salinity (ppm)																																	
1. Rock Slough	DSM2	250	251	254	253	nc	nc	258	258	255	222	234	258	258	253	227	240	nc	nc	nc	nc	nc	258	259	258	253	227	240	nc	nc	nc	nc	nc
2. North Bay	DSM2	143	142	143	142	nc	nc	142	141	141	142	141	140	140	140	140	140	nc	nc	nc	nc	nc	140	140	139	140	140	140	nc	nc	nc	nc	nc
3. South Bay	DSM2	261	262	264	264	nc	nc	267	267	264	237	247	267	266	263	240	251	nc	nc	nc	nc	nc	266	267	266	262	240	251	nc	nc	nc	nc	nc
4. Mokelumne	East Bay MUD	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
5. Hetch-Hetchy	Footnote 12.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. Local Supplies	Footnote 13.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Consumptive Use of Applied Water																																	
1. Urban	B 160 / Hydrology	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag	B 160 / Hydrology	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Francisco Bay Region
Long-Term Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
		Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic																																	
Urban																																	
1. Total Cost of Supplies ($/AF)																																	
Local Supply	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Hetch Hetchy Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mokelumne Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
CVP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
SWP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
New Facilities	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Transfers	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2. Total Local Option Cost ($1,000)	LCPSIM	32,404	32,483	37,793	36,885	33,467	30,997	12,642	14,760	13,608	15,401	22,351	6,177	8,136	15,804	4,799	12,434	9,652	10,352	13,817	9,580	13,817	25,843	26,956	26,843	25,248	25,929	28,274	28,652	32,310	29,041	32,310	27,106
Regional Fixed Option Cost ($1,000)	LCPSIM	1,106	1,106	0	0	1,217	2,102	0	1,659	3,260	1,880	0	1,659	2,911	0	1,659	0	0	1,659	2,102	1,770	2,102	0	0	0	0	0	0	0	0	0	0	0
Recycling	LCPSIM	1,106	1,106	0	0	1,217	2,102	0	1,659	2,212	1,880	0	1,659	2,212	0	1,659	0	0	1,659	2,102	1,770	2,102	0	0	0	0	0	0	0	0	0	0	0
Conservation	LCPSIM	0	0	0	0	0	0	0	0	1,048	0	0	0	699	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Groundwater	LCPSIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ocean Water Desalting	LCPSIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shortage Cost ($1,000)	LCPSIM	31,298	31,377	37,793	36,885	32,250	28,895	12,642	13,101	10,348	13,521	22,351	4,518	5,225	15,804	3,140	12,434	9,652	8,693	11,716	7,810	11,716	25,843	26,956	26,843	25,248	25,929	28,274	28,652	32,310	29,041	32,310	27,106
3. Marginal Fixed Option Cost ($/AF)	LCPSIM	111	111	111	111	111	111	111	111	349	111	111	111	349	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111
4. Treatment Costs	Footnote 15.	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Central & South Coast Regions
Long-Term Average

Resource Mix	Data	Base Conditions: Existing		Base Conditions: No Action		Base Conditions: Ex.NA. BASE		Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Source /	Water Supply	Water Supply	Water Supply	Water Supply	Water Supply	Water Supply	Water Supply	Water Supply	Water Supply	Water Quality	Water Quality	Water Supply	Water Supply	Water Supply	Water Quality	Water Quality	Water Supply	Water Supply	Water Supply	Water Quality	Water Quality	Water Supply	Water Supply	Water Supply	Water Supply	Water Quality	Water Quality	Water Supply	Water Supply	Water Supply	Water Quality	Water Quality
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Other Imports																																	
Colorado Aqueduct	LCPSIM	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
LA Aqueduct	LCPSIM	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348
Fixed Supply	LCPSIM	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438
2. Delta Imports (Central Coast)																																	
Base Bay-Delta Supply	Allocation Process	0	0	54	52	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
Facility Benefit	Allocation Process	0	0	0	0	0	0	8	5	4	6	3	17	14	9	15	8	15	11	6	13	6	8	7	6	4	8	4	8	5	3	7	3
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	0	0	0	0
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	2	4	6	3	6	2	2	4	2	4	2	3	5	2	5	1	1	1	2	1	2	1	1	2	1	2
Interruptible	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Bay-Delta Supply	Allocation Process	0	0	54	52	47	47	57	56	57	56	56	66	63	60	65	59	64	62	58	63	58	56	56	55	52	57	53	56	54	52	55	52
3. Delta Imports (South Coast)																																	
Base Bay-Delta Supply	Allocation Process	1,294	1,266	1,677	1,631	1,399	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396
Facility Benefit	Allocation Process	0	0	0	0	0	0	259	169	124	190	82	480	359	241	395	213	436	280	157	352	157	238	202	175	105	215	110	214	144	77	178	77
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	6	12	12	9	13	18	19	27	21	28	22	26	38	25	38	8	9	9	10	31	32	9	10	11	10	11
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	69	124	171	101	180	56	69	117	67	114	67	93	153	79	153	36	39	44	52	42	49	39	46	54	44	54
Interruptible	Allocation Process	0	0	24	19	0	0	0	0	0	0	0	35	32	29	34	26	31	25	25	28	25	35	37	32	29	34	26	31	25	25	28	25
Net Bay-Delta Supply	Allocation Process	1,294	1,266	1,701	1,650	1,399	1,396	1,731	1,701	1,704	1,697	1,672	1,986	1,875	1,809	1,913	1,778	1,953	1,821	1,769	1,880	1,769	1,714	1,683	1,657	1,593	1,718	1,612	1,688	1,621	1,563	1,657	1,563
4. Regional Option Use	LCPSIM	946	916	625	653	837	841	565	586	581	575	599	347	452	494	471	524	334	507	530	432	530	553	609	664	554	654	570	635	694	602	694	581
Recycling	LCPSIM	445	422	325	330	351	351	291	303	300	297	310	153	238	250	240	268	140	258	271	237	271	284	316	330	285	330	294	330	330	312	330	300
Conservation/Re-Use	LCPSIM	401	401	224	243	393	397	224	224	224	224	224	194	212	224	224	224	194	224	224	194	224	224	224	254	224	244	224	225	284	224	284	224
Groundwater	LCPSIM	95	93	76	80	93	93	50	59	57	54	65	0	2	20	7	33	0	25	35	1	35	45	69	80	45	80	52	80	80	66	80	57
Ocean Water Desalting	LCPSIM	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Quality																																	
Salt Load (1000 Tons/yr)																																	
1. SWP Delta	DSM2	530	542	660	649	nc	nc	589	591	574	502	520	740	720	677	652	642	nc	nc	nc	nc	nc	739	728	720	677	652	642	nc	nc	nc	nc	nc
2. LA Aqueduct	Footnote 16.																																
3. Colorado Aqueduct	Footnote 16.																																
4. Local Supplies	Footnote 16.																																
5. Recycling/Desal	Footnote 16.																																
Salinity (EC)																																	
1. SWP Delta	DSM2	273	279	276	279	nc	nc	286	288	281	246	258	285	289	281	250	266	nc	nc	nc	nc	nc	285	287	289	281	250	266	nc	nc	nc	nc	nc
2. LA Aqueduct	Footnote 16.																																
3. Colorado Aqueduct	Footnote 16.																																
4. Local Supplies	Footnote 16.																																
5. Recycling/Desal	Footnote 16.																																

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Central & South Coast Regions
Long-Term Average

Resource Mix	Data Source / Footnotes	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
		Existing		No Action		Ex.NA. BASE																											
Operational Priority		Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level		None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic																																	
Urban																																	
1. Total Cost of Supplies ($/AF)																																	
Local Supply	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
LA Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Colorado Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
SWP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
New Facilities	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Transfers	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2. Total Cost ($1,000)	LCPSIM	703,773	682,217	537,309	545,634	618,831	638,973	321,696	352,241	334,591	366,158	388,882	274,732	321,192	310,925	289,387	332,060	329,108	367,742	336,158	377,296	336,158	392,520	428,248	451,295	397,398	433,235	412,370	440,676	484,276	444,345	484,276	413,995
Regional Fixed Option Cost ($1,000)	LCPSIM	575,738	544,279	285,063	308,387	471,941	475,666	243,403	257,330	253,950	249,947	266,305	131,389	179,433	201,530	189,717	218,241	126,307	208,595	221,755	168,007	221,755	235,760	273,392	317,992	236,389	309,260	246,655	292,669	344,188	268,414	344,188	253,950
Conservation	LCPSIM	258,993	258,993	98,032	114,532	251,308	255,034	98,032	98,032	98,032	98,032	98,032	80,568	91,135	98,032	98,032	98,032	80,568	98,032	98,032	80,568	98,032	98,032	98,032	124,137	98,032	115,405	98,032	98,814	150,333	98,032	150,333	98,032
Groundwater Recovery	LCPSIM	60,954	58,881	45,552	48,477	58,881	58,881	27,698	33,666	32,218	30,502	37,513	0	723	9,752	3,310	16,914	0	12,780	18,420	569	18,420	24,422	40,550	48,477	24,692	48,477	29,091	48,477	48,477	38,417	48,477	32,218
Water Recycling	LCPSIM	250,436	226,405	141,479	145,378	161,751	161,751	117,673	125,632	123,700	121,413	130,760	50,821	87,575	93,746	88,375	103,295	45,739	97,783	105,303	86,870	105,303	113,306	134,810	145,378	113,665	145,378	119,532	145,378	145,378	131,965	145,378	123,700
Ocean Water Desalting	LCPSIM	5,356	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shortage Cost ($1,000)	LCPSIM	128,035	137,938	252,246	237,247	146,890	163,307	78,293	94,911	80,641	116,211	122,577	143,344	141,759	109,395	99,669	113,819	202,801	159,147	114,403	209,289	114,403	156,759	154,856	133,303	161,009	123,975	165,715	148,007	140,087	175,932	140,087	160,045
3. Marginal Fixed Option Cost ($/AF)	LCPSIM	1,078	1,014	743	873	931	931	647	681	673	663	702	397	582	534	488	582	386	555	591	465	591	628	718	873	630	873	655	873	873	706	873	673
4. Treatment Costs	Footnote 17.	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region

Dry and Critcal Year Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Source /	Existing Water Supply		No Action Water Supply		Ex.NA. Water Supply	BASE	Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
		EXIST	EXIST_1	NA	NA_1	EXIST_NA	BASE	A_S_1	A_S_2	A_S_3	A_Q_1	A_Q_3	B_S_1	B_S_2	B_S_3	B_Q_1	B_Q_3	B_S_1_NSS	B_S_2_NSS	B_S_3_NSS	B_Q_1_NSS	B_Q_3_NSS	C_S_1	C_S_1_20	C_S_2	C_S_3	C_Q_1	C_Q_3	C_S_1_NSS	C_S_2_NSS	C_S_3_NSS	C_Q_1_NSS	C_Q_3_NSS
System Operations																																	
Surface Water (TAF/yr)																																	
1. Trinity Imports	DWRSIM	559	557	560	559	559	559	556	553	550	556	551	547	540	539	546	536	553	553	554	550	554	547	505	540	539	546	536	553	553	554	550	554
2. Unstored Inflow	DWRSIM	8,036	8,044	7,943	7,966	7,966	7,966	7,918	7,905	7,910	7,900	7,908	7,893	7,887	7,908	7,874	7,871	7,899	7,905	7,917	7,885	7,917	7,893	7,986	7,887	7,908	7,874	7,871	7,899	7,905	7,917	7,885	7,917
3. Stored Inflows																																	
Existing Storage	DWRSIM	3,220	3,154	3,230	3,176	3,176	3,176	3,248	3,231	3,206	3,359	3,231	3,136	3,122	3,060	3,222	3,063	3,233	3,192	3,058	3,319	3,058	3,136	3,174	3,122	3,060	3,222	3,063	3,233	3,192	3,058	3,319	3,058
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	52	52	49	51	52	53	62	71	63	71	59	63	83	60	83	53	56	62	71	63	71	59	63	83	60	83
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	304	283	253	326	269	0	0	0	0	0	304	185	283	253	326	269	0	0	0	0	0
4. Upstream Exports	DWRSIM	20	20	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
5. Sacramento Outflow																																	
Unstored	DWRSIM	5,991	5,995	5,907	5,930	5,930	5,930	5,871	5,858	5,865	5,857	5,863	5,838	5,835	5,853	5,819	5,806	5,843	5,849	5,863	5,832	5,863	5,838	5,909	5,835	5,853	5,819	5,806	5,843	5,849	5,863	5,832	5,863
Existing Storage	DWRSIM	3,104	3,036	3,075	3,020	3,020	3,020	3,089	3,070	3,044	3,202	3,067	2,970	2,952	2,887	3,057	2,894	3,075	3,030	2,896	3,160	2,896	2,970	3,003	2,952	2,887	3,057	2,894	3,075	3,030	2,896	3,160	2,896
New Storage	DWRSIM	0	0	0	0	0	0	53	53	50	53	54	357	345	324	389	340	60	64	85	62	85	357	241	345	324	389	340	60	64	85	62	85
Transfers for ERP	DWRSIM	0	0	0	0	0	0	173	171	169	174	170	167	163	157	170	159	173	167	163	176	163	167	171	163	157	170	159	173	167	163	176	163
Transfers for Water Users	Allocation Analysis	0	0	0	0	0	0	39	53	62	49	62	93	103	159	115	160	115	137	183	126	183	46	42	46	56	160	184	49	56	59	49	59
Reservoir Operations																																	
1. Carryover Storage																																	
Existing Storage	DWRSIM	3,703	3,830	3,561	3,651	3,651	3,651	3,478	3,545	3,556	3,246	3,500	3,855	3,913	4,088	3,722	4,110	3,618	3,725	4,006	3,422	4,006	3,855	3,664	3,913	4,088	3,722	4,110	3,618	3,725	4,006	3,422	4,006
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	1,061	1,128	1,248	1,026	1,211	0	0	0	0	0	1,061	823	1,128	1,248	1,026	1,211	0	0	0	0	0
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	414	419	428	414	423	415	404	388	392	385	402	396	366	399	366	415	406	404	388	392	385	402	396	366	399	366
2. Maximum Storage																																	
Existing Storage	DWRSIM	6,432	6,485	6,322	6,327	6,327	6,327	6,279	6,330	6,331	6,122	6,283	6,502	6,539	6,683	6,432	6,709	6,394	6,470	6,638	6,235	6,638	6,502	6,361	6,539	6,683	6,432	6,709	6,394	6,470	6,638	6,235	6,638
New Surface Storage	DWRSIM	0	0	0	0	0	0	0	0	0	0	0	1,321	1,362	1,471	1,282	1,432	0	0	0	0	0	1,321	985	1,362	1,471	1,282	1,432	0	0	0	0	0
New Groundwater Storage	DWRSIM	0	0	0	0	0	0	439	446	455	439	450	440	436	426	424	422	431	428	414	429	414	440	434	436	426	424	422	431	428	414	429	414
3. Shasta Levels																																	
No. of events below 1,900 TAF	DWRSIM	11	9	14	13	13	13	12	11	11	13	10	12	11	12	14	10	10	11	11	11	11	12	15	11	12	14	10	10	11	11	11	11
No. of events below 1,200 TAF	DWRSIM	6	6	7	6	6	6	7	6	7	8	7	7	7	7	7	7	7	6	7	7	7	7	7	7	7	7	7	7	6	7	7	7
Consumptive Use of Applied Water																																	
Upland Areas																																	
1. Refuge	Footnote 1. & 2.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	B 160 / Hydrology	471	nc	534	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	155	nc	212	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater Basin																																	
1. Refuge	Footnote 1.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hyd	4,552	nc	4,528	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hyd	397	nc	640	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region
Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality			Water Supply			Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	1,582	1,565	nc	nc	nc	1,564	1,543	nc	nc	nc	1,539	nc	nc	nc	nc	nc	1,563	nc	nc	nc	nc	1,564	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	110	105	nc	nc	nc	105	101	nc	nc	nc	100	nc	nc	nc	nc	nc	105	nc	nc	nc	nc	105	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	79	78	nc	nc	nc	78	77	nc	nc	nc	77	nc	nc	nc	nc	nc	78	nc	nc	nc	nc	78	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	55	55	nc	nc	nc	55	54	nc	nc	nc	54	nc	nc	nc	nc	nc	55	nc	nc	nc	nc	55	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	162	161	nc	nc	nc	161	159	nc	nc	nc	159	nc	nc	nc	nc	nc	161	nc	nc	nc	nc	161	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	460	451	nc	nc	nc	451	439	nc	nc	nc	437	nc	nc	nc	nc	nc	450	nc	nc	nc	nc	450	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	69	69	nc	nc	nc	69	69	nc	nc	nc	69	nc	nc	nc	nc	nc	69	nc	nc	nc	nc	69	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	113	113	nc	nc	nc	113	113	nc	nc	nc	113	nc	nc	nc	nc	nc	113	nc	nc	nc	nc	113	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	320	320	nc	nc	nc	320	320	nc	nc	nc	320	nc	nc	nc	nc	nc	320	nc	nc	nc	nc	320	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	193	192	nc	nc	nc	192	189	nc	nc	nc	189	nc	nc	nc	nc	nc	192	nc	nc	nc	nc	192	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	8	8	nc	nc	nc	8	8	nc	nc	nc	8	nc	nc	nc	nc	nc	8	nc	nc	nc	nc	8	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	14	14	nc	nc	nc	14	14	nc	nc	nc	14	nc	nc	nc	nc	nc	14	nc	nc	nc	nc	14	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Analysis	0	0	0	0	0	0	12	23	33	17	35	9	11	19	11	19	11	15	25	13	25	15	16	18	23	17	23	16	19	25	18	25
Dry & Critical Years (28 Years)	Allocation Analysis	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	68	nc	nc	nc	65	95	nc	nc	nc	93	nc	nc	nc	nc	nc	69	nc	nc	nc	nc	67	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Sacramento Region

Dry and Critcal Year Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Source /	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority		Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Groundwater																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM / CVPM	nc	nc	nc	nc	nc	3,980	nc	nc	nc	nc	3,984	3,980	nc	nc	nc	3,983	nc	nc	nc	nc	nc	3,976	nc	nc	nc	nc	3,979	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 1	CVGSM	nc	nc	nc	nc	nc	420	nc	nc	nc	nc	420	420	nc	nc	nc	420	nc	nc	nc	nc	nc	420	nc	nc	nc	nc	420	nc	nc	nc	nc	nc
CVGSM Subregion 2	CVGSM	nc	nc	nc	nc	nc	168	nc	nc	nc	nc	168	168	nc	nc	nc	168	nc	nc	nc	nc	nc	168	nc	nc	nc	nc	168	nc	nc	nc	nc	nc
CVGSM Subregion 3	CVGSM	nc	nc	nc	nc	nc	106	nc	nc	nc	nc	106	106	nc	nc	nc	106	nc	nc	nc	nc	nc	106	nc	nc	nc	nc	106	nc	nc	nc	nc	nc
CVGSM Subregion 4	CVGSM	nc	nc	nc	nc	nc	42	nc	nc	nc	nc	42	42	nc	nc	nc	42	nc	nc	nc	nc	nc	42	nc	nc	nc	nc	42	nc	nc	nc	nc	nc
CVGSM Subregion 5	CVGSM	nc	nc	nc	nc	nc	73	nc	nc	nc	nc	73	73	nc	nc	nc	73	nc	nc	nc	nc	nc	73	nc	nc	nc	nc	73	nc	nc	nc	nc	nc
CVGSM Subregion 6	CVGSM	nc	nc	nc	nc	nc	35	nc	nc	nc	nc	35	35	nc	nc	nc	35	nc	nc	nc	nc	nc	35	nc	nc	nc	nc	35	nc	nc	nc	nc	nc
CVGSM Subregion 7	CVGSM	nc	nc	nc	nc	nc	-21	nc	nc	nc	nc	-21	-21	nc	nc	nc	-21	nc	nc	nc	nc	nc	-21	nc	nc	nc	nc	-21	nc	nc	nc	nc	nc
CVGSM Subregion 8	CVGSM	nc	nc	nc	nc	nc	7	nc	nc	nc	nc	7	7	nc	nc	nc	7	nc	nc	nc	nc	nc	7	nc	nc	nc	nc	7	nc	nc	nc	nc	nc
CVGSM Subregion 9	CVGSM	nc	nc	nc	nc	nc	17	nc	nc	nc	nc	17	17	nc	nc	nc	17	nc	nc	nc	nc	nc	17	nc	nc	nc	nc	17	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-854	nc	nc	nc	nc	-857	-857	nc	nc	nc	-857	nc	nc	nc	nc	nc	-855	nc	nc	nc	nc	-856	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	147	nc	nc	nc	nc	147	147	nc	nc	nc	147	nc	nc	nc	nc	nc	147	nc	nc	nc	nc	147	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	1,992	nc	nc	nc	nc	1,991	1,991	nc	nc	nc	1,992	nc	nc	nc	nc	nc	1,992	nc	nc	nc	nc	1,991	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	736	nc	nc	nc	nc	737	735	nc	nc	nc	736	nc	nc	nc	nc	nc	733	nc	nc	nc	nc	735	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping																																	
South Sacramento Co.	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs																																	
South Sacramento Co.	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region
Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Tulare Basin (James Bypass) Inflow	DWRSIM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Unstored Inflow	DWRSIM	2,586	2,581	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572	2,572
3. Stored Inflows																																	
Existing Storage	DWRSIM	907	909	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969	969
New Groundwater Storage	Footnote 4.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Total Delta Import Deliveries																																	
Base Bay-Delta Supply	Allocation Analysis	959	918	933	896	962	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917	917
New Facility Benefit	Allocation Analysis	0	0	0	0	0	0	5	3	0	5	1	23	14	6	26	7	13	10	3	13	3	101	83	78	51	85	44	69	42	17	49	17
Transfers to Urban	Allocation Analysis	0	0	0	0	0	0	-102	-133	-156	-126	-156	-70	-79	-117	-89	-118	-89	-105	-136	-98	-136	-45	-43	-45	-53	-46	-51	-49	-56	-58	-51	-58
Transfers in from NOD	Allocation Analysis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Interruptible	Allocation Analysis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Bay-Delta Supply	Allocation Analysis	959	918	933	896	962	917	820	788	762	796	762	870	852	807	854	806	841	823	783	833	783	973	958	950	915	956	912	938	903	877	916	877
5. Upstream Exports																																	
Friant-Kern	DWRSIM	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739	739
Hetch-Hetchy	Footnote 5.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. San Joaquin Outflow	DWRSIM	1,275	1,266	1,321	1,318	1,318	1,318	1,349	1,346	1,347	1,346	1,345	1,344	1,344	1,341	1,342	1,342	1,347	1,344	1,345	1,345	1,345	1,344	1,343	1,344	1,341	1,342	1,342	1,347	1,344	1,345	1,345	1,345
Unstored	DWRSIM	779	770	784	783	783	783	784	783	784	783	783	782	782	781	782	781	784	783	783	783	783	782	782	782	781	782	781	784	783	783	783	783
Existing Storage	DWRSIM	494	495	536	534	534	534	536	534	535	534	534	533	533	532	532	532	535	533	534	534	534	533	532	533	532	532	532	535	533	534	534	534
Transfers (ERPP)	DWRSIM	0	0	0	0	0	0	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Reservoir Operations																																	
1. Carryover Storage	DWRSIM	2,489	2,503	2,424	2,422	2,422	2,422	2,423	2,423	2,423	2,423	2,422	2,422	2,422	2,421	2,422	2,421	2,423	2,422	2,422	2,423	2,422	2,422	2,422	2,422	2,421	2,422	2,421	2,423	2,422	2,422	2,423	2,422
Existing Storage	Footnote 6.																																
New Groundwater Storage	Footnote 4.																																
2. Maximum Storage	DWRSIM	3,554	3,567	3,481	3,480	3,480	3,480	3,481	3,480	3,480	3,480	3,480	3,480	3,479	3,478	3,479	3,478	3,480	3,479	3,479	3,480	3,479	3,480	3,480	3,479	3,478	3,479	3,478	3,480	3,479	3,479	3,480	3,479
Existing Storage	Footnote 6.																																
New Groundwater Storage	Footnote 4.																																
Consumptive Use of Applied Water																																	
Upland Areas																																	
1. Refuge	Footnote 2.																																
2. Ag.	B 160 / Hydrology	13	nc	18	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	27	nc	49	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater Basin																																	
1. Refuge	Footnote 1.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hyd	3,075	nc	2,851	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hyd	149	nc	252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region
Dry and Critcal Year Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
Operational Priority	Source /	Existing Water Supply		No Action Water Supply		Ex.NA. BASE Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	1,617	1,576	nc	nc	nc	1,586	1,575	nc	nc	nc	1,571	nc	nc	nc	nc	nc	1,602	nc	nc	nc	nc	1,602	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	161	151	nc	nc	nc	154	151	nc	nc	nc	151	nc	nc	nc	nc	nc	156	nc	nc	nc	nc	157	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	122	113	nc	nc	nc	115	112	nc	nc	nc	111	nc	nc	nc	nc	nc	118	nc	nc	nc	nc	119	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	32	32	nc	nc	nc	32	32	nc	nc	nc	32	nc	nc	nc	nc	nc	32	nc	nc	nc	nc	32	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	204	197	nc	nc	nc	199	197	nc	nc	nc	196	nc	nc	nc	nc	nc	202	nc	nc	nc	nc	202	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	16	15	nc	nc	nc	15	15	nc	nc	nc	15	nc	nc	nc	nc	nc	15	nc	nc	nc	nc	15	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	157	157	nc	nc	nc	157	157	nc	nc	nc	157	nc	nc	nc	nc	nc	157	nc	nc	nc	nc	157	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	61	60	nc	nc	nc	60	60	nc	nc	nc	60	nc	nc	nc	nc	nc	61	nc	nc	nc	nc	61	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	393	393	nc	nc	nc	393	393	nc	nc	nc	393	nc	nc	nc	nc	nc	393	nc	nc	nc	nc	393	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	100	98	nc	nc	nc	99	97	nc	nc	nc	97	nc	nc	nc	nc	nc	99	nc	nc	nc	nc	99	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	183	183	nc	nc	nc	183	183	nc	nc	nc	183	nc	nc	nc	nc	nc	183	nc	nc	nc	nc	183	nc	nc	nc	nc	nc
Cotton	CVPM	nc	nc	nc	nc	nc	176	166	nc	nc	nc	168	166	nc	nc	nc	164	nc	nc	nc	nc	nc	173	nc	nc	nc	nc	173	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	11	11	nc	nc	nc	11	11	nc	nc	nc	11	nc	nc	nc	nc	nc	11	nc	nc	nc	nc	11	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Process	0	0	0	0	0	0	12	23	33	17	35	9	11	19	11	19	11	15	25	13	25	15	16	18	23	17	23	16	19	25	18	25
Dry & Critical Years (28 Years)	Allocation Process	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	220	nc	nc	nc	155	270	nc	nc	nc	224	nc	nc	nc	nc	nc	171	nc	nc	nc	nc	154	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Joaquin Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
<u>Groundwater</u>																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM/CVPM	nc	nc	nc	nc	nc	2,029	nc	nc	nc	nc	2,143	2,048	nc	nc	nc	2,106	nc	nc	nc	nc	nc	1,985	nc	nc	nc	nc	2,030	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 10	CVGSM	nc	nc	nc	nc	nc	95	nc	nc	nc	nc	90	96	nc	nc	nc	93	nc	nc	nc	nc	nc	99	nc	nc	nc	nc	96	nc	nc	nc	nc	nc
CVGSM Subregion 11	CVGSM	nc	nc	nc	nc	nc	47	nc	nc	nc	nc	47	47	nc	nc	nc	47	nc	nc	nc	nc	nc	47	nc	nc	nc	nc	47	nc	nc	nc	nc	nc
CVGSM Subregion 12	CVGSM	nc	nc	nc	nc	nc	62	nc	nc	nc	nc	62	62	nc	nc	nc	62	nc	nc	nc	nc	nc	62	nc	nc	nc	nc	62	nc	nc	nc	nc	nc
CVGSM Subregion 13	CVGSM	nc	nc	nc	nc	nc	84	nc	nc	nc	nc	81	87	nc	nc	nc	83	nc	nc	nc	nc	nc	90	nc	nc	nc	nc	85	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-686	nc	nc	nc	nc	-746	-699	nc	nc	nc	-728	nc	nc	nc	nc	nc	-682	nc	nc	nc	nc	-685	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	60	nc	nc	nc	nc	60	60	nc	nc	nc	60	nc	nc	nc	nc	nc	60	nc	nc	nc	nc	60	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	723	nc	nc	nc	nc	723	723	nc	nc	nc	723	nc	nc	nc	nc	nc	723	nc	nc	nc	nc	724	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	306	nc	nc	nc	nc	366	291	nc	nc	nc	337	nc	nc	nc	nc	nc	251	nc	nc	nc	nc	297	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Madera Ranch	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
San Joaquin Co,	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B				
	Data	Existing		No Action		Ex.NA. BASE											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3
System Operations																	
Surface Water (TAF/yr)																	
1. Friant-Kern Imports	DWRSIM	766	766	766	766	766	766	766	766	766	766	766	766	766	766	766	766
2. Unstored Inflow	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Stored Inflows	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Total Delta Import Deliveries																	
Base Bay-Delta Supply	Allocation Process	1,276	1,213	1,228	1,157	1,214	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152
New Facility Benefit	Allocation Process	0	0	0	0	0	0	11	6	1	11	2	61	38	18	69	20
Transfers to Urban	Allocation Process	0	0	0	0	0	0	-103	-141	-172	-132	-174	-72	-82	-131	-89	-125
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interruptible	Allocation Process	123	106	43	43	123	106	132	105	87	121	83	81	67	58	75	50
Net Bay-Delta Supply	Allocation Process	1,399	1,319	1,271	1,200	1,337	1,258	1,192	1,123	1,068	1,152	1,063	1,222	1,176	1,098	1,206	1,098
5. Upstream Exports	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
6. Tulare Outflow																	
James Bypass	DWRSIM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Consumptive Use of Applied Water																	
Upland Areas																	
1. Refuge	Footnote 2.																
2. Ag.	Footnote 8.																
3. Urban	Footnote 8.																
Groundwater Basin																	
1. Refuge	Footnote 1.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hydı	6,620	nc	6,152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hydı	260	nc	501	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

Resource Mix		Alternative B					Alternative C						Alternative C				
	Data	No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																	
Surface Water (TAF/yr)																	
1. Friant-Kern Imports	DWRSIM	766	766	766	766	766	766	766	766	766	766	766	766	766	766	766	766
2. Unstored Inflow	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Stored Inflows	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Total Delta Import Deliveries																	
Base Bay-Delta Supply	Allocation Process	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152
New Facility Benefit	Allocation Process	35	29	8	35	8	265	219	202	131	224	116	183	111	44	131	44
Transfers to Urban	Allocation Process	-89	-109	-149	-99	-149	-55	-50	-55	-61	-54	-57	-58	-65	-64	-57	-64
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Interruptible	Allocation Process	66	53	46	62	46	81	74	67	58	75	50	66	53	46	62	46
Net Bay-Delta Supply	Allocation Process	1,164	1,125	1,057	1,150	1,057	1,444	1,395	1,367	1,280	1,397	1,263	1,344	1,252	1,179	1,288	1,179
5. Upstream Exports	Footnote 7.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
6. Tulare Outflow																	
James Bypass	DWRSIM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Consumptive Use of Applied Water																	
Upland Areas																	
1. Refuge	Footnote 2.																
2. Ag.	Footnote 8.																
3. Urban	Footnote 8.																
Groundwater Basin																	
1. Refuge	Footnote 1.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag.	CVGSM/B 160 / Hydı	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	CVGSM/B 160 / Hydı	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region

Dry and Critcal Year Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
		Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
<u>Economic/Land Use</u>	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Land Use (Groundwater Basin)																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	2,868	2,869	nc	nc	nc	2,865	2,868	nc	nc	nc	2,868	nc	nc	nc	nc	nc	2,870	nc	nc	nc	nc	2,868	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	17	17	nc	nc	nc	17	17	nc	nc	nc	17	nc	nc	nc	nc	nc	17	nc	nc	nc	nc	17	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	230	231	nc	nc	nc	230	231	nc	nc	nc	231	nc	nc	nc	nc	nc	230	nc	nc	nc	nc	230	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	25	25	nc	nc	nc	25	25	nc	nc	nc	25	nc	nc	nc	nc	nc	25	nc	nc	nc	nc	25	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	220	220	nc	nc	nc	220	220	nc	nc	nc	220	nc	nc	nc	nc	nc	220	nc	nc	nc	nc	220	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	0	0	nc	nc	nc	0	0	nc	nc	nc	0	nc	nc	nc	nc	nc	0	nc	nc	nc	nc	0	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	350	350	nc	nc	nc	350	350	nc	nc	nc	350	nc	nc	nc	nc	nc	350	nc	nc	nc	nc	350	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	84	84	nc	nc	nc	84	84	nc	nc	nc	84	nc	nc	nc	nc	nc	84	nc	nc	nc	nc	84	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	349	349	nc	nc	nc	349	349	nc	nc	nc	349	nc	nc	nc	nc	nc	349	nc	nc	nc	nc	349	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	139	139	nc	nc	nc	138	138	nc	nc	nc	139	nc	nc	nc	nc	nc	137	nc	nc	nc	nc	138	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	363	363	nc	nc	nc	363	363	nc	nc	nc	363	nc	nc	nc	nc	nc	363	nc	nc	nc	nc	363	nc	nc	nc	nc	nc
Cotton	CVPM	nc	nc	nc	nc	nc	904	905	nc	nc	nc	902	905	nc	nc	nc	904	nc	nc	nc	nc	nc	906	nc	nc	nc	nc	905	nc	nc	nc	nc	nc
Subtropical	CVPM	nc	nc	nc	nc	nc	188	188	nc	nc	nc	188	188	nc	nc	nc	188	nc	nc	nc	nc	nc	188	nc	nc	nc	nc	188	nc	nc	nc	nc	nc
2. Number of Land Fallow Transfers																																	
Long Term (73 Years)	Allocation Process	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
Dry & Critical Years (28 Years)	Allocation Process	0	0	0	0	0	0	12	16	19	15	19	8	9	14	10	14	10	12	16	11	16	14	13	14	17	14	16	15	17	18	15	18
3. Marginal Cost of Transfers ($/acre ft)	CVPM	nc	nc	nc	nc	nc	nc	321	nc	nc	nc	232	369	nc	nc	nc	295	nc	nc	nc	nc	nc	313	nc	nc	nc	nc	280	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Tulare Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Groundwater																																	
Basin-wide																																	
1. Total Basin Pumping	CVGSM / CVPM	nc	nc	nc	nc	nc	6,634	nc	nc	nc	nc	6,785	6,629	nc	nc	nc	6,756	nc	nc	nc	nc	nc	6,449	nc	nc	nc	nc	6,616	nc	nc	nc	nc	nc
2. Pumping Costs (TAF/yr)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	Footnote 3.																																
CVGSM Subregion 14	CVGSM	nc	nc	nc	nc	nc	149	nc	nc	nc	nc	139	167	nc	nc	nc	146	nc	nc	nc	nc	nc	186	nc	nc	nc	nc	160	nc	nc	nc	nc	nc
CVGSM Subregion 15	CVGSM	nc	nc	nc	nc	nc	46	nc	nc	nc	nc	41	55	nc	nc	nc	44	nc	nc	nc	nc	nc	65	nc	nc	nc	nc	51	nc	nc	nc	nc	nc
CVGSM Subregion 16	CVGSM	nc	nc	nc	nc	nc	119	nc	nc	nc	nc	117	122	nc	nc	nc	119	nc	nc	nc	nc	nc	126	nc	nc	nc	nc	121	nc	nc	nc	nc	nc
CVGSM Subregion 17	CVGSM	nc	nc	nc	nc	nc	178	nc	nc	nc	nc	177	178	nc	nc	nc	177	nc	nc	nc	nc	nc	178	nc	nc	nc	nc	178	nc	nc	nc	nc	nc
CVGSM Subregion 18	CVGSM	nc	nc	nc	nc	nc	205	nc	nc	nc	nc	204	206	nc	nc	nc	204	nc	nc	nc	nc	nc	207	nc	nc	nc	nc	205	nc	nc	nc	nc	nc
CVGSM Subregion 19	CVGSM	nc	nc	nc	nc	nc	285	nc	nc	nc	nc	278	291	nc	nc	nc	281	nc	nc	nc	nc	nc	299	nc	nc	nc	nc	288	nc	nc	nc	nc	nc
CVGSM Subregion 20	CVGSM	nc	nc	nc	nc	nc	220	nc	nc	nc	nc	216	225	nc	nc	nc	218	nc	nc	nc	nc	nc	230	nc	nc	nc	nc	222	nc	nc	nc	nc	nc
CVGSM Subregion 21	CVGSM	nc	nc	nc	nc	nc	360	nc	nc	nc	nc	354	364	nc	nc	nc	356	nc	nc	nc	nc	nc	370	nc	nc	nc	nc	362	nc	nc	nc	nc	nc
4. Annual Change in Storage	CVGSM	nc	nc	nc	nc	nc	-2,190	nc	nc	nc	nc	-2,328	-2,237	nc	nc	nc	-2,302	nc	nc	nc	nc	nc	-2,108	nc	nc	nc	nc	-2,202	nc	nc	nc	nc	nc
5. Non-Recoverable Losses	CVGSM	nc	nc	nc	nc	nc	37	nc	nc	nc	nc	37	38	nc	nc	nc	37	nc	nc	nc	nc	nc	38	nc	nc	nc	nc	38	nc	nc	nc	nc	nc
6. Net Deep Percolation	CVGSM	nc	nc	nc	nc	nc	2,088	nc	nc	nc	nc	2,085	2,086	nc	nc	nc	2,087	nc	nc	nc	nc	nc	2,085	nc	nc	nc	nc	2,086	nc	nc	nc	nc	nc
7. Gain From Stream	CVGSM	nc	nc	nc	nc	nc	817	nc	nc	nc	nc	848	784	nc	nc	nc	832	nc	nc	nc	nc	nc	740	nc	nc	nc	nc	799	nc	nc	nc	nc	nc
Conjunctive Use Area																																	
1. Total Pumping	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Pumping Costs	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Groundwater Levels	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Recharge	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
King River Fan	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Kern Water Bank	CVGSM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Delta Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Delta Inflow (Sacramento River)																																	
Unstored	DWRSIM	5,991	5,995	5,907	5,930	5,930	5,930	5,871	5,858	5,865	5,857	5,863	5,838	5,835	5,853	5,819	5,806	5,843	5,849	5,863	5,832	5,863	5,838	5,909	5,835	5,853	5,819	5,806	5,843	5,849	5,863	5,832	5,863
Existing Storage	DWRSIM	3,104	3,036	3,075	3,020	3,020	3,020	3,089	3,070	3,044	3,202	3,067	2,970	2,952	2,887	3,057	2,894	3,075	3,030	2,896	3,160	2,896	2,970	3,003	2,952	2,887	3,057	2,894	3,075	3,030	2,896	3,160	2,896
New Storage	DWRSIM	0	0	0	0	0	0	53	53	50	53	54	357	345	324	389	340	60	64	85	62	85	357	241	345	324	389	340	60	64	85	62	85
Transfers	Allocation Process	0	0	0	0	0	0	39	53	62	49	62	93	103	159	115	160	115	137	183	126	183	46	42	46	56	160	184	49	56	59	49	59
2. Delta Inflow (San Joaquin River)																																	
Unstored	Allocation Process	779	770	784	783	783	783	784	783	784	783	783	782	782	781	782	781	784	783	783	783	783	782	782	782	781	782	781	784	783	783	783	783
Existing Storage	DWRSIM	494	495	536	534	534	534	536	534	535	534	534	533	533	532	532	532	535	533	534	534	534	533	532	533	532	532	532	535	533	534	534	534
3. Delta Exports																																	
Exports from Unstored Inflow	DWRSIM	2,632	2,599	2,743	2,686	2,686	2,686	2,653	2,548	2,500	2,478	2,411	2,817	2,682	2,575	2,667	2,507	2,791	2,650	2,559	2,638	2,559	2,817	2,799	2,682	2,575	2,667	2,507	2,791	2,650	2,559	2,638	2,559
Exports from Stored Inflow	DWRSIM	2,136	2,059	2,134	2,078	2,078	2,078	2,203	2,183	2,154	2,199	2,143	2,362	2,338	2,243	2,397	2,254	2,183	2,141	2,025	2,185	2,025	2,362	2,270	2,338	2,243	2,397	2,254	2,183	2,141	2,025	2,185	2,025
4. Delta Export Deliveries																																	
Base Deliveries	Allocation Process	3,800	3,676	3,883	3,735	3,799	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677	3,677
New Facility Benefit	Allocation Process	0	0	0	0	0	0	298	163	122	159	33	580	442	290	489	258	398	234	94	274	94	580	470	442	290	489	258	398	234	94	274	94
Interruptible	Allocation Process	127	109	63	63	127	109	136	108	89	125	85	113	94	79	104	69	94	74	64	87	64	113	106	94	79	104	69	94	74	64	87	64
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	19	24	24	24	25	47	46	58	58	64	60	67	80	66	80	21	21	22	23	74	72	26	27	27	26	27
Unused Facility Benefit	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Forecast Delivery Shortages (taf)	DWRSIM	14	16	20	36	36	36	62	116	167	76	161	62	98	76	62	83	55	95	51	58	51	62	37	98	76	62	83	55	95	51	58	51
Number of Forecast Shortages	DWRSIM	7	10	8	10	10	10	12	14	18	15	20	13	17	17	12	18	12	16	15	13	15	13	10	17	17	12	18	12	16	15	13	15
Max. Forecast Shortages (taf)	DWRSIM	149	130	252	216	216	216	254	529	662	336	573	591	529	316	549	281	251	408	294	318	294	591	236	529	316	549	281	251	408	294	318	294
5. Net Delta Outflow	DWRSIM	5,874	5,912	5,795	5,873	5,873	5,873	6,038	6,127	6,179	6,313	6,308	5,862	5,975	6,102	6,073	6,142	5,887	6,026	6,126	6,112	6,126	5,862	5,945	5,975	6,102	6,073	6,142	5,887	6,026	6,126	6,112	6,126
Outflow from Unstored Inflow	DWRSIM	4,846	4,875	4,760	4,835	4,835	4,835	5,008	5,096	5,148	5,168	5,237	4,815	4,934	5,055	4,942	5,082	4,849	4,988	5,084	4,990	5,084	4,815	4,893	4,934	5,055	4,942	5,082	4,849	4,988	5,084	4,990	5,084
Outflow from Storaged Inflow	DWRSIM	1,028	1,037	1,035	1,038	1,038	1,038	1,031	1,031	1,031	1,145	1,070	1,047	1,042	1,047	1,131	1,060	1,038	1,038	1,042	1,122	1,042	1,047	1,052	1,042	1,047	1,131	1,060	1,038	1,038	1,042	1,122	1,042
Outlfow from ERP Flows (Transfers)	DWRSIM	0	0	0	0	0	0	201	199	197	202	198	195	190	184	197	187	201	194	190	204	190	195	198	190	184	197	187	201	194	190	204	190
Outflow from Transfer Loss	Allocation Process	0	0	0	0	0	0	20	29	38	25	37	46	57	101	56	95	55	70	103	60	103	24	21	24	33	86	112	23	29	32	23	32
6. Mean X2 Position	DWRSIM	81	81	81	81	81	81	81	81	81	80	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
7. Mean Qwest	DWRSIM	-98	-92	-102	-94	-94	-94	-99	-90	-83	-82	-75	-123	-111	-96	-112	-91	-110	-95	-81	-96	-81	-123	-116	-111	-96	-112	-91	-110	-95	-81	-96	-81
8. Delta Cross Flow	DWRSIM	2,681	2,662	2,662	2,649	2,649	2,649	2,702	2,696	2,693	2,730	2,698	2,728	2,719	2,702	2,757	2,701	2,692	2,683	2,654	2,709	2,654	2,728	2,714	2,719	2,702	2,757	2,701	2,692	2,683	2,654	2,709	2,654

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Delta Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Water Quality																																	
Salt Load (1000 Tons/yr)																																	
1. Clifton Court	DSM2	724	764	971	978	nc	nc	812	788	845	791	798	1,044	1,057	1,049	938	976	nc	nc	nc	nc	nc	1,042	1,022	1,058	1,048	938	976	nc	nc	nc	nc	nc
2. Tracy	DSM2	734	717	736	711	nc	nc	664	664	680	664	672	715	680	681	670	674	nc	nc	nc	nc	nc	715	701	680	681	670	674	nc	nc	nc	nc	nc
3. Rock Slough	DSM2	41	41	44	44	nc	nc	42	41	41	40	40	46	46	46	43	43	nc	nc	nc	nc	nc	46	47	46	46	43	43	nc	nc	nc	nc	nc
4. North Bay	DSM2	8	8	9	9	nc	nc	8	8	8	8	8	10	9	9	10	9	nc	nc	nc	nc	nc	10	9	9	9	10	9	nc	nc	nc	nc	nc
Salinity (ppm)																																	
1. Clifton Court	DSM2	419	419	422	421	nc	nc	429	428	418	339	373	430	428	423	353	395	nc	nc	nc	nc	nc	430	435	428	423	353	395	nc	nc	nc	nc	nc
2. Tracy	DSM2	461	462	465	463	nc	nc	481	482	463	376	427	477	474	467	386	445	nc	nc	nc	nc	nc	477	482	474	467	386	445	nc	nc	nc	nc	nc
3. Rock Slough	DSM2	426	427	431	430	nc	nc	443	441	427	353	400	438	438	427	358	411	nc	nc	nc	nc	nc	438	443	438	427	358	411	nc	nc	nc	nc	nc
4. North Bay	DSM2	163	162	163	164	nc	nc	161	161	163	162	160	158	158	160	155	159	nc	nc	nc	nc	nc	158	162	157	160	155	159	nc	nc	nc	nc	nc
5. Emmaton	DSM2	990	940	986	948	nc	nc	971	942	945	661	793	929	917	917	663	818	nc	nc	nc	nc	nc	929	943	917	917	663	818	nc	nc	nc	nc	nc
6. Jersey Point	DSM2	882	882	880	859	nc	nc	892	890	891	602	749	915	910	908	628	792	nc	nc	nc	nc	nc	915	915	910	908	628	792	nc	nc	nc	nc	nc
Consumptive Use of Applied Water																																	
1. Refuge	Footnote 9.																																
2. Ag.	B 160 / Hydrology	1,052	nc	1,031	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Urban	B 160 / Hydrology	48	nc	70	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Economic/Land Use	Footnote 18.																																
Agricultural Economics																																	
1. Regional Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Statewide Value of Production ($1000)	CVPM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Employment Change (# jobs) Irrigated Prod.	IMPLAN / Foot. 19.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Employment Change (# jobs) Transfer Revenue	IMPLAN / Foot. 20.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
5. Total Employment (# jobs)	IMPLAN / Foot. 21.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Total Region Land Use																																	
1. Total Basin Land Use (1000 acres)	CVPM	nc	nc	nc	nc	nc	421	421	nc	nc	nc	421	421	nc	nc	nc	421	nc	nc	nc	nc	nc	420	nc	nc	nc	nc	421	nc	nc	nc	nc	nc
Pasture	CVPM	nc	nc	nc	nc	nc	24	24	nc	nc	nc	24	24	nc	nc	nc	24	nc	nc	nc	nc	nc	24	nc	nc	nc	nc	24	nc	nc	nc	nc	nc
Alfalfa	CVPM	nc	nc	nc	nc	nc	43	43	nc	nc	nc	43	43	nc	nc	nc	43	nc	nc	nc	nc	nc	43	nc	nc	nc	nc	43	nc	nc	nc	nc	nc
Sugarbeets	CVPM	nc	nc	nc	nc	nc	29	29	nc	nc	nc	29	29	nc	nc	nc	29	nc	nc	nc	nc	nc	29	nc	nc	nc	nc	29	nc	nc	nc	nc	nc
FieldCrops	CVPM	nc	nc	nc	nc	nc	114	114	nc	nc	nc	114	114	nc	nc	nc	114	nc	nc	nc	nc	nc	114	nc	nc	nc	nc	114	nc	nc	nc	nc	nc
Rice	CVPM	nc	nc	nc	nc	nc	1	1	nc	nc	nc	1	1	nc	nc	nc	1	nc	nc	nc	nc	nc	1	nc	nc	nc	nc	1	nc	nc	nc	nc	nc
Truck	CVPM	nc	nc	nc	nc	nc	46	46	nc	nc	nc	46	46	nc	nc	nc	46	nc	nc	nc	nc	nc	46	nc	nc	nc	nc	46	nc	nc	nc	nc	nc
Tomato	CVPM	nc	nc	nc	nc	nc	42	42	nc	nc	nc	42	42	nc	nc	nc	42	nc	nc	nc	nc	nc	42	nc	nc	nc	nc	42	nc	nc	nc	nc	nc
Orchard	CVPM	nc	nc	nc	nc	nc	21	21	nc	nc	nc	21	21	nc	nc	nc	21	nc	nc	nc	nc	nc	21	nc	nc	nc	nc	21	nc	nc	nc	nc	nc
Grain	CVPM	nc	nc	nc	nc	nc	94	94	nc	nc	nc	95	94	nc	nc	nc	94	nc	nc	nc	nc	nc	93	nc	nc	nc	nc	94	nc	nc	nc	nc	nc
Grapes	CVPM	nc	nc	nc	nc	nc	6	6	nc	nc	nc	6	6	nc	nc	nc	6	nc	nc	nc	nc	nc	6	nc	nc	nc	nc	6	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Francisco Bay Region

Dry and Critcal Year Average

Resource Mix	Data	Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
		Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water & Groundwater (TAF/yr)																																	
1. Hetch-Hetchy & Mokelumne Imports	LCPSIM / Footnote 10.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Delta Imports																																	
Base Bay-Delta Supply	Allocation Process	338	338	332	334	338	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333
Facility Benefit	Allocation Process	0	0	0	0	0	0	15	5	3	3	-4	25	22	14	18	10	16	1	-7	5	-7	10	8	9	6	7	2	5	1	-1	1	-1
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	2	2	2	2	3	4	4	6	6	6	7	7	8	7	8	2	2	2	2	7	7	2	3	3	2	3
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	19	23	26	21	29	10	12	19	17	21	16	17	22	18	22	9	9	9	10	9	10	10	10	11	10	11
Interruptible	Allocation Process	3	3	1	2	3	3	4	3	2	4	2	3	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2
Net Bay-Delta Supply	Allocation Process	342	341	333	336	342	336	372	366	367	363	362	375	373	374	376	372	374	359	357	365	357	357	354	355	353	359	354	353	349	347	348	347
Fixed Supply	LCPSIM / Footnote 11.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Regional Option Use	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Recycling	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Conservation/Re-Use	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Ocean Water Desalting	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Water Quality																																	
Salt Load (1000 Tons/yr)																																	
1. Rock Slough	DSM2	41	41	44	44	nc	nc	42	41	41	40	40	46	46	46	43	43	nc	nc	nc	nc	nc	46	47	46	46	43	43	nc	nc	nc	nc	nc
2. North Bay	DSM2	8	8	9	9	nc	nc	8	8	8	8	8	10	9	9	10	9	nc	nc	nc	nc	nc	10	9	9	9	10	9	nc	nc	nc	nc	nc
3. South Bay	DSM2	47	46	43	41	nc	nc	47	46	46	45	45	44	43	41	43	41	nc	nc	nc	nc	nc	44	43	43	41	43	41	nc	nc	nc	nc	nc
4. Mokelumne	East Bay MUD	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
5. Hetch-Hetchy	Footnote 12.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. Local Supplies	Footnote 13.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Salinity (ppm)																																	
1. Rock Slough	DSM2	426	427	431	430	nc	nc	443	441	427	353	400	438	438	427	358	411	nc	nc	nc	nc	nc	438	443	438	427	358	411	nc	nc	nc	nc	nc
2. North Bay	DSM2	163	162	163	164	nc	nc	161	161	163	162	160	158	158	160	155	159	nc	nc	nc	nc	nc	158	162	157	160	155	159	nc	nc	nc	nc	nc
3. South Bay	DSM2	419	416	422	421	nc	nc	429	428	418	339	373	430	428	423	353	395	nc	nc	nc	nc	nc	430	435	428	423	353	395	nc	nc	nc	nc	nc
4. Mokelumne	East Bay MUD	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
5. Hetch-Hetchy	Footnote 12.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
6. Local Supplies	Footnote 13.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Consumptive Use of Applied Water																																	
1. Urban	B 160 / Hydrology	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Ag	B 160 / Hydrology	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

San Francisco Bay Region

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B No New Surface Storage					Alternative C						Alternative C No New Surface Storage				
	Data	Existing		No Action		Ex.NA. BASE																											
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
<u>Economic</u>																																	
Urban																																	
1. Total Cost of Supplies ($/AF)																																	
Local Supply	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Hetch Hetchy Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mokelumne Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
CVP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
SWP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
New Facilities	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Transfers	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2. Total Local Option Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Regional Fixed Option Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Recycling	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Conservation	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Ocean Water Desalting	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Shortage Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Marginal Fixed Option Cost ($/AF)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Treatment Costs	Footnote 15.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

CALFED Water Management Strategy Comprehensive Evaluation Report Card

Central & South Coast Regions

Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
System Operations																																	
Surface Water (TAF/yr)																																	
1. Other Imports																																	
Colorado Aqueduct	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
LA Aqueduct	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Fixed Supply	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
2. Delta Imports (Central Coast)																																	
Base Bay-Delta Supply	Allocation Process	0	0	42	41	42	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41
Facility Benefit	Allocation Process	0	0	0	0	0	0	8	5	4	5	1	16	13	9	13	8	11	7	3	7	3	7	5	5	3	6	3	5	3	1	3	1
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1	1	1	2	2	1	1	1	1	1
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	6	8	9	7	9	4	4	7	5	7	5	6	8	5	8	3	3	3	3	3	3	3	3	4	3	4
Interruptible	Allocation Process	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Bay-Delta Supply	Allocation Process	0	0	42	41	42	41	56	55	55	54	53	62	60	58	61	58	59	56	55	56	55	51	50	50	49	52	50	50	48	47	48	47
3. Delta Imports (South Coast)																																	
Base Bay-Delta Supply	Allocation Process	1,227	1,208	1,348	1,306	1,243	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233	1,233
Facility Benefit	Allocation Process	0	0	0	0	0	0	259	143	113	135	32	455	355	243	362	213	322	186	87	214	87	196	155	148	100	167	93	136	77	32	90	32
Transfers in from NOD	Allocation Process	0	0	0	0	0	0	17	20	21	21	21	41	41	50	51	56	52	58	70	57	70	19	19	19	19	65	62	23	23	23	23	23
Transfers in from SOD	Allocation Process	0	0	0	0	0	0	181	243	292	230	292	129	144	222	157	215	158	192	255	173	255	88	82	88	101	88	94	94	108	107	94	107
Interruptible	Allocation Process	0	0	18	18	0	0	0	0	0	0	0	29	24	20	27	17	25	19	17	23	17	29	30	24	20	27	17	25	19	17	23	17
Net Bay-Delta Supply	Allocation Process	1,227	1,208	1,366	1,325	1,243	1,233	1,689	1,640	1,660	1,620	1,579	1,888	1,798	1,767	1,830	1,734	1,790	1,688	1,663	1,700	1,663	1,565	1,518	1,512	1,472	1,580	1,498	1,511	1,460	1,412	1,464	1,412
4. Regional Option Use	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Recycling	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Conservation/Re-Use	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Ocean Water Desalting	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Water Quality																																	
Salt Load (1000 Tons/yr)																																	
1. SWP Delta	DSM2	758	766	933	903	nc	nc	863	859	857	695	746	1,028	1,006	906	857	839	nc	nc	nc	nc	nc	1,028	1,007	1,006	907	857	839	nc	nc	nc	nc	nc
2. LA Aqueduct	Footnote 16.																																
3. Colorado Aqueduct	Footnote 16.																																
4. Local Supplies	Footnote 16.																																
5. Recycling/Desal	Footnote 16.																																
Salinity (EC)																																	
1. SWP Delta	DSM2	410	413	420	417	nc	nc	429	426	416	334	375	430	425	417	347	381	nc	nc	nc	nc	nc	430	430	425	417	347	381	nc	nc	nc	nc	nc
2. LA Aqueduct	Footnote 16.																																
3. Colorado Aqueduct	Footnote 16.																																
4. Local Supplies	Footnote 16.																																
5. Recycling/Desal	Footnote 16.																																

CALFED Water Management Strategy Comprehensive Evaluation
Report Card

Central & South Coast Regions
Dry and Critcal Year Average

Resource Mix		Base Conditions						Alternative A					Alternative B					Alternative B					Alternative C						Alternative C				
	Data	Existing		No Action		Ex.NA. BASE												No New Surface Storage											No New Surface Storage				
Operational Priority	Source /	Water Supply		Water Supply		Water Supply		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply			Water Quality		Water Supply				Water Quality		Water Supply			Water Quality	
Fisheries Benefit Level	Footnotes	None	1	None	1	None	1	1	2	3	1	3	1	2	3	1	3	1	2	3	1	3	1	1,20	2	3	1	3	1	2	3	1	3
Economic																																	
Urban																																	
1. Total Cost of Supplies ($/AF)																																	
Local Supply	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
LA Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Colorado Aqueduct	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
SWP Delta	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
New Facilities	Footnote 14.	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Transfers	Cost Allocation	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2. Total Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Regional Fixed Option Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Conservation	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Groundwater Recovery	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Water Recycling	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Ocean Water Desalting	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Shortage Cost ($1,000)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
3. Marginal Fixed Option Cost ($/AF)	LCPSIM	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
4. Treatment Costs	Footnote 17.	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc

Appendix C
Planning Assumptions

C.1 Introduction

The basic ground rules of the Water Management Strategy Evaluation Framework are the planning assumptions. Planning assumptions reflect the real-world conditions and constraints within which alternatives must function. As illustrated in Figure C-1, establishing the ground rules is the initial step in the evaluation process.

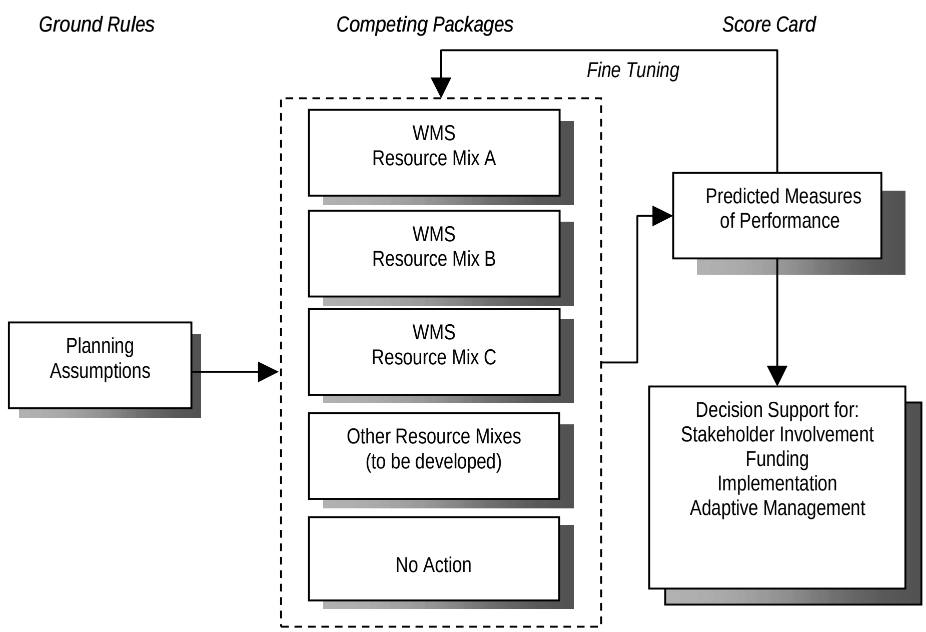

Figure C-1 Alternatives Evaluation Process Overview

Planning assumptions provide an agreed-upon context within which each alternative strategy is compared. Mostly, these assumptions reflect external realities or constraints imposed on the choices of each strategy. Some planning assumptions represent flexible constraints. For instance, Delta Standards and future regulatory requirements may change over time in response to changing priorities or new information. For comparative purposes, however, it is important to develop an understanding of how those constraints are treated in the evaluation.

Finally, adjusting planning assumptions and repeating the analysis also allows for an assessment of the sensitivity of performance to changing or uncertain circumstances. The sensitivity to changing future conditions like hydrology or water demands is itself a measure of an alternative's durability — one of the important CALFED Solution Principles.

This appendix presents a summary of the planning assumptions used in the preliminary evaluation of alternatives. They fall into the following general categories of hydrologic, operational, and regulatory. They also include implicit assumptions regarding the future flows needed for implementation of the Ecosystem Restoration Program.

C.2 Conceptual Model

The Bay-Delta system is the hub of California's two largest water distribution systems — the Central Valley Project (CVP) operated by the U.S. Bureau of Reclamation and the State Water Project (SWP) operated by the California Department of Water Resources (DWR). The modeling effort to evaluate alternatives is based on a conceptual model, which focuses on the seven major regions within the CALFED solution area.

Figure C-2 illustrates the State of California, the seven regions within the CALFED solution area, and various CVP and SWP waterways and projects. Urban and agricultural land and water uses are considered within each region. To simplify the analysis and presentation of results, the San Francisco Bay Area and South Coast regions are considered to be primarily urban regions, and the Sacramento, San Joaquin and Tulare regions are primarily agricultural. The Central Coast, with its smaller level of development, is included with the South Coast.

C.2.1 Hydrology

The WMS Evaluation Framework uses historical climatic and surface water flow data within the CALFED study area. The analysis assumes that the measured historical 73-year hydrologic sequence (water-years 1922-94) is characteristic of the long-term climatic and hydrologic conditions that will be seen in the future. Over this period, water year classification indices developed for the Sacramento River basin characterize 28 years as "dry" or "critical," and 21 years as "wet." The comprehensive evaluation results are presented as a "long-term average," representing annual averages over the entire 73-year period, or as a "dry and critical average," which represents annual averages over the selected dry and critical years that are based on the Sacramento Valley index.

The historical hydrology was adjusted to reflect 1995 land use conditions in the existing conditions case, and projected 2020 land use for future conditions. Changes in land use result in different amounts of upstream water use, as well as altered runoff patterns, and these changes were reflected in the future hydrology. In addition, the 1995 level hydrology incorporates and accounts for 1995 consumptive use demands for upstream users. The 2020 level hydrology incorporates the projected future consumptive use demands of upstream users in 2020. The 2020 land use projections are based on Bulletin 160-98[1], which forecasts a decline in irrigated agricultural acreage.

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[1] *The California Water Plan Update Bulletin 160-98.* (California Department of Water Resources, 1998)

C.2.2 Systems Operation

Assumptions regarding SWP and CVP system operations play an important role in defining the relative performance of alternatives. System operations assumptions address projected ranges in water demand and regulatory requirements. The ranges of water demands that represent future needs for Bay-Delta water supplies are discussed below. These ranges reflect some of the uncertainties associated with projections of population, land use, implementation of water use efficiency measures, and the effects of water marketing.

C.2.2.1 State Water Project Demands and Deliveries

The SWP has long-term water supply contracts with 29 agencies including both agricultural agencies and municipal and industrial (M&I) users. The total amount of water contracted for in these agreements is approximately 4.2 MAF[2]. Table C-1 presents existing (1995) and future (2020) SWP demand assumptions for both wet and dry years.

The SWP sets delivery targets for each contractor based on a comparison of their contractual amount to the amount of water available for delivery. These predictions are performed monthly from January through May, and are based on carryover storage and current wet-season precipitation. Projections become more accurate as the year continues because more data is available, and the final projection in May will be the final demand target for the year. If the delivery targets are not enough to meet demand, cuts are imposed equally on agricultural and M&I contractors in proportion to contractual amounts.

The modeling analysis is similar to real-world operations. The assumed SWP contractor demands are shown in Table C-1. The model simulates monthly operations to determine if specified delivery targets are met. It imposes cuts in a slightly different way than the real world in that the model assumes that cuts are based on the difference between delivery targets, which do not always reflect full contract amounts, and projected water demands for that year.

[2] Except where stated otherwise herein, MAF means million acre-feet delivered during the 12-month water year ending September 30 of the named year (if any) and beginning October 1 of the year preceding.

Table C-1
Assumed 1995 and 2020 SWP Water Demands[1]

	1995 Development		2020 Development	
	Dry/Avg Year Demands (MAF)	Wet Year Demands (MAF)	Dry/Avg Year Demands (MAF)	Wet Year Demands (MAF)
Maximum Agricultural[2] Demands	1.15	0.92	1.15	0.92
Maximum Metropolitan Water District Demands[3]	1.43	0.78	2.01	1.32
Maximum Other M&I Demands[4]	0.88	0.88	0.97	0.97
Fixed Losses and Recreation	0.06	0.06	0.06	0.06
Total SWP Demands	**3.52**	**2.64**	**4.19**	**3.27**

[1] SWP ***Demand Assumptions***: For 1995 and 2020 development south-of-Delta SWP demands are based on local water year classification indices. The SWP demands of San Joaquin Valley agricultural contractors use a Kern River flow index, and SWP demands from MWD use a Southern California precipitation index based on two-year averages at 10 weather stations. Deliveries to all other SWP M&I contractors are not adjusted based on local water-year wetness indices.

[2] Kern River flow index.

[3] Southern California precipitation index, based on 2-year averages at 10 weather stations.

[4] Not adjusted to local water-year wetness indices.

C.2.2.2 Central Valley Project Demands and Deliveries

The CVP south-of-Delta demands are assumed to be distributed approximately 90 percent to agricultural and M&I uses, and 10 percent to wildlife refuges.

The CVP calculates delivery targets on a monthly basis, similar to the process undertaken by the SWP. Delivery targets are based on the ratio of contractual supplies (with appropriate cuts) to the amount of water supply available during that year. The targets are updated monthly from February to May to account for uncertainty regarding available supplies. If water supply is not adequate to meet contractual demand, cuts are imposed. The process to determine cuts for the CVP is more complex than the SWP because the contracts delineate different cuts depending on the type of water use. Agricultural water users are cut first, then M&I water users, and then exchange contractors and wildlife refuges.

The WMS Evaluation Framework modeling replicates these conditions based on the assumed demands shown in Table C-2. Delivery targets are calculated at the beginning of each month, and analyzed to determine if the targets are met during the remainder of the year. The analysis assumes a priority for delivery reductions as shown in Table C-3. The analysis starts with the initial cuts and iterates through the process until the delivery targets equal the amount of water supply available.

Table C-2 Assumed 1995 and 2020 CVP Contractor Demands		
	1995 Development (MAF)	2020 Development (MAF)
Delta Mendota Canal and Exchange Contractors	1.56	1.56
CVP San Luis Unit	1.26	1.45
CVP San Felipe Unit	0.20	0.20
Cross Valley Canal	0.13	0.13
Level II Wildlife Refuge	0.29	0.29
Total CVP Demands	**3.44**	**3.63**

The higher priority Exchange Contractor and Wildlife Refuge demands are limited to reductions of 75 percent of their original demands unless Agricultural and M&I demands are reduced to zero and further reductions are still required. In these instances, the reductions are shared equally between Exchange Contractors and Refuges.

Table C-3 CVP Delivery Reductions				
Water user	***First Round***	***Second Round***	***Third Round***	***Fourth Round***
Agricultural	50%	25%	25%	
M&I		25%	25%	50%
Exchange		25%		
Refuge			25%	

C.3 Regulatory Assumptions

C.3.1 Delta Water Quality Standards

The operation of CVP and SWP Delta export facilities is coordinated with upstream project reservoirs to meet the State Water Resources Control Board's (SWRCB) May 1995 Water Quality Control Plan (WQCP). The comprehensive evaluation assumes that WQCP requirements are in effect. The models coordinate the use of upstream project reservoirs and Delta export facilities in order to meet the following requirements:

Export Limits. As shown in Table C-4, maximum allowable Delta exports are established as a percentage of total Delta inflow. During February, the export ratio can vary as a function of the January Eight River Index.

Table C-4 Export/Import Ratio	
Period	***Percent of Total Delta Inflow***
October — January	65
February	35 — 45
March — June	35
July — September	65

The April 15 to May 15 total Delta exports are limited to 1,500 cfs or 100 percent of the San Joaquin River three- day average flow at Vernalis, whichever is greater. If necessary, additional water is provided from the San Joaquin River upstream of its confluence with the Stanislaus River to meet salinity and pulse flow objectives at Vernalis.

Additional water requirements are shared equally between the Tuolumne (New Don Pedro Reservoir) and Merced (Lake McClure) River basins. If these sources are insufficient to meet objectives at Vernalis, nominal deficiencies are applied to upstream demands. Additional releases from the Tuolumne and Merced Rivers are assumed to be of fresh-water quality (not more than 50 milligrams per liter [mg/L] total dissolved solids [TDS]). Furthermore, it is assumed that these additional releases are not subject to losses between the reservoirs and Vernalis.

X2 Requirement. X2 is the distance upstream from the Golden Gate Bridge to the point where the daily average salinity is 2 parts per thousand. During February through June, outflow requirements are maintained in accordance with the WQCP's 2.64 electrical conductivity (EC, an index of salinity) and X2 criteria, using the required number of days at Chipps Island and Roe Island.

Water Quality Objectives. The analysis of the water quality objective at the Contra Costa Canal intake is maintained in accordance with the WQCP. Because system modeling is performed on a monthly time-step, a buffer was developed to ensure that the chloride standard is maintained on a daily basis. Thus, all modeling assumed a maximum value of 130 mg/L for the 150-mg/L standard and a maximum value of 225 mg/L for the 250 mg/L standard.

Water quality objectives in the Sacramento River at Emmaton and in the San Joaquin River at Jersey Point are also assumed to be maintained in accordance with the WQCP. The water quality objectives in the San Joaquin River at Vernalis are 0.7 µmhos/cm EC in April through August and 1.0 µmhos/cm EC in all other months. These objectives are maintained primarily by releasing water from New Melones Reservoir. A cap on water quality releases is imposed according to criteria outlined in an April 26, 1996 letter from the US Bureau of Reclamation (USBR) to the SWRCB. The cap varies between 70 and 200 TAF/year, depending on New Melones storage and projected inflow. The interior Delta standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing) are not modeled in the WMS alternatives.

Table C-5 presents average high tide EC standards to be maintained at Collinsville for eastern Suisun Marsh salinity control. All other Suisun Marsh standards are assumed to be met through operation of the Suisun Marsh salinity control gates.

Table C-5 EC Standards at Collinsville (mhos/cm)							
Oct.	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**
19.0	15.5	15.5	12.5	8.0	8.0	11.0	11.0

Delta Cross Channel (DCC) Gate Operations: Under the 1995 WQCP, the DCC is closed for 10 days in November, 15 days in December, and 20 days in January, for a total closure of 45 days. The DCC is fully closed from February 1 through May 20 of all years and is closed for an additional 14 days between May 21 and June 15. This requirement is represented in the model, as well as the Delta Cross Channel operation requirements from the Central Valley Project Improvement Act (contained in the following section). The combined requirements indicate that the DCC is open from June 5 – September 30, and closed at all other times of the year.

C.3.2 Central Valley Project Improvement Act

Under the WMSEF analysis, CVP facilities are also assumed to be operated to meet the Central Valley Project Improvement Act Section (b)(2) [CVPIA (b)(2)] requirements under the Revised Draft Anadromous Fish Restoration Plan (AFRP). The AFRP prescribes upstream and Delta actions required to meet the CVPIA (b)(2) requirement of dedicating and managing 0.8 MAF of CVP yield for fish and wildlife and habitat restoration purposes. The analysis assumes that AFRP upstream actions will maintain minimum instream flows in Clear Creek, Sacramento River, American River and Stanislaus River.

The analysis includes actions to simulate the standards included in the Department of Interior's November 20, 1997 "Final Administrative Proposal on the Management of Section 3406(b)(2) Water."

- *Action 1* -Requires maintaining target flow conditions during April 15 through May 15 according to the Vernalis Adaptive Management Plan (VAMP). The VAMP is a scientifically based adaptive fishery management plan intended to provide protective measures for fall-run Chinook salmon and provide additional scientific information on survival of salmon.

- *Action 3* - Requires maintaining Chipps Island X2 days from March-June at 1962 level of development.

- *Action 4* - Requires maintaining Sacramento River 7-day average flow at Freeport from 9,000 to 15,000 cfs for striped bass spawning during a 30-day period in May.

- *Action 5* - Requires ramping San Joaquin flows down, or ramping Delta exports up, for up to 15 additional days following the Action 1 pulse flow period depending on presence of salmon at Mossdale and the Delta Smelt take limit at the pumps.

- *Action 6* - Requires closing the Delta Cross Channel (DCC) gates from October-January for all water-year types.

- *Action 7* - Requires maintaining July flow and exports based on the June X2 position.

These actions provide an approximation of (b)(2), but to do not reflect the final plan.

C.3.3 Pumping Plant Capacities, Coordinated Operation, and Wheeling

Banks Pumping Plant. The SWP Banks Pumping Plant average monthly delivery is 6,680 cfs (or 8,500 cfs in some winter months), in accordance with the US Army Corps of Engineers (COE) October 31, 1981 Public Notice criteria. Pumping is limited to 3,000 cfs in May and June and 4,600 cfs in July to comply with D-1485 criteria for striped bass survival. Additionally, on the basis of a January 5, 1987 interim agreement between the State Department of Water Resources (DWR) and the Department of Fish and Game (DFG), SWP pumping is limited to 2,000 cfs in any May or June in which withdrawal is required from Oroville Reservoir.

The analysis of future pumping plant operations includes actions that deviate from present operations. The capacity at Banks pumping facility will increase to 10,300 cfs to reflect the South Delta Improvements being implemented by CALFED. This expansion allows more water to be pumped when the conditions in the Delta are appropriate, and reduces the pressure to pump water during more sensitive periods. The total capacity at Banks is thus assumed to be 10,300 cfs for all alternatives.

The analysis includes a variable "fishery benefits" schedule that reduces pumping during critical months for fish. This schedule varies per alternative.

Tracy Pumping Plant. The CVP Tracy Pumping Plant capacity is 4,600 cfs, but constraints along the Delta-Mendota Canal and at the relift pumps (to O'Neill Forebay) can restrict export capacity to as low as 4,200 cfs.

Coordinated Operation Agreement. The analysis assumes that sharing between CVP and SWP of responsibility for the coordinated operation of the two projects is maintained in accordance with the Coordinated Operation Agreement. Storage withdrawals for in-basin use are split 75 percent for CVP and 25 percent for SWP. Unstored flows for storage and export are split 55 percent CVP and 45 percent SWP.

Joint Point of Diversion. The SWP and CVP pumping facilities could not pump water for the other project prior to CALFED. Joint Point of Diversion allows the projects to pump water if they have met their requirements. Joint Point of Diversion is included in the comprehensive evaluation of all alternatives.

Wheeling. All alternatives are assumed to allow "wheeling" of CVP water through SWP facilities. "Wheeling" is the delivery of water through conveyance facilities owned by a separate entity, and usually involves payment to owner of the facilities.

Trinity River Imports. The analysis assumes that Trinity River minimum fish flows below Lewiston Dam are maintained at 815 TAF/year for all years, to approximate a new agreement on the Trinity River.

East Bay Municipal Utility District American River Diversions. The comprehensive evaluation assumes no diversions from the American River by East Bay Municipal Utility District (EBMUD).

C.4 Ecosystem Restoration Program

All alternatives considered under the WMSEF include the Ecosystem Restoration Program (ERP) flow targets shown in Table C-6. The ERP water for instream flows and Delta outflow targets are available only for environmental uses. Shortfalls in ERP flow are made up through an "add water" function to simulate acquisitions from willing sellers.

The ERP flow targets shown in Table C-6 are typically 10-day minimum pulse flows intended to emulate the seasonal streamflow patterns to:

- Mobilize and transport sediments;
- Allow upstream and downstream fish passage;
- Contribute to riparian vegetation succession;
- Permit transport of larval fish to the entrapment zone;
- Maintain low salinity in Suisun Bay; and
- Provide adequate attraction flows for upstream through-Bay migrating salmon.

Table C-6
Ecosystem Restoration Program Spring Flow Targets (cfs)

Location	***Month (Time Period)***	***Water Year Classification***				
		Critical	***Dry***	***Below Normal***	***Above Normal***	***Wet***
Delta Outflow	March (10 day period)	-	20,000	30,000	40,000	-
	April-May (10 day period)	-	20,000	30,000	40,000	-
Sacramento River at Freeport	May	-	13,000	13,000	13,000	13,000
Sacramento River at Knights Landing	March (10 day period)	-	7,500	17,500	17,500	-
Feather River at Gridley	March (10 day period)	-	5,000	7,000	9,000	-
Yuba River at Marysville	March (10 day period)	-	2,500	3,500	3,500	-
American River at Nimbus Dam	March (10 day period)	-	3,500	5,000	5,000	7,000
Stanislaus River at Goodwin Dam	April/May (10 day period)	-	-	2,750	2,750	3,500
Tuolumne River at La Grange	April/May (10 day period)	-	2,750	3,750	3,750	5,500
Merced River at Shaffer Bridge	April/May (10 day period)	-	1,250	2,250	2,250	3,750

Appendix D
Glossary

Action A structure, set of operating criteria, program, regulation, policy, or restoration activity that is intended to address a problem or resolve a conflict in the Bay-Delta system.

Adaptive Management Implementation of immediate or near real-time measures and actions on an as-needed basis that are designed to augment previous facilities and/or policies in order to enhance the functionality of the specified system.

AF Abbreviation for acre-feet; an acre-foot is the volume of water that would cover one acre to a depth of one foot, or 325,851 gallons of water. On average, an acre-foot could supply 1 to 2 households with water for a year. A flow of 1 cubic foot per second for a day is approximately 2 AF.

Alternative A collection of actions or combinations of actions assembled to provide a comprehensive solution to problems in the Bay-Delta system.

AFRP Anadromous Fish Restoration Program, part of the Central Valley Project Improvement Act. The AFRP identified instream and Delta flows needed for recovery of anadromous fish.

Anadromous Fish Fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

Analytical Tools Procedures and computer programs or models used to perform analyses of processes and other computational needs.

B(2) Water Statutory mandate to manage the water dedicated to fish and wildlife purposes pursuant to Section 3406(b)(2) of the Central Valley Project Improvement Act.

Banks Pumping Plant The State Water Project export pumping plant in the south Delta. The plant is located downstream of Clifton Court Forebay.

Bay-Delta System The San Francisco Bay/Sacramento-San Joaquin Delta estuary, a region of critical importance as the hub of California's water supply system, and an area of unsurpassed ecological importance for salmon, migratory waterfowl, and a host of other plants and animals.

Base Year The base year is essentially the existing conditions with local, state, and federal projects and/or actions and policies that are authorized or under construction projects assumed as in place.

CALFED The consortium of eight State of California and ten federal agencies established to address the critical water management issues affecting the ecological health, water quality, and water supply reliability of the San Francisco Bay / Sacramento-San Joaquin Delta region.

Central Valley Project (CVP) Federally owned and operated water management and conveyance system that provides water to agricultural, urban, and industrial users in California. The CVP was originally authorized by legislation in 1937.

Central Valley Ground-Surface Water Simulation Model (CVGSM) A computer model of the entire Central Valley that models the interactions between regional aquifers and major streams.

Central Valley Production Model (CVPM) A computer model developed by DWR and updated by U.S. Bureau of Reclamation. It is a regional model of irrigated agriculture within the Central Valley that simulates farmer's decisions when faced with changing hydrologic and economic conditions and predicts the corresponding changes in land and water use.

Central Valley Project Improvement Act (CVPIA) Federal legislation, signed into law on October 30, 1992, that mandates major changes in the management of the federal Central Valley Project. The CVPIA puts fish and wildlife on an equal footing with agricultural, municipal, industrial, and hydropower users.

Channel Islands Natural, unleveed land masses within Delta channels. Typically good sources of habitat.

Clifton Court Forebay The in-Delta storage used to regulate flows to the Banks Pumping Plant.

Common Delta Pool Delta provides a common resource, including fresh water supply for all Delta water users, and all those whose actions have an impact on the Delta environment share in the obligation to restore, maintain and protect Delta resources, including water supplies, water quality, and natural habitat.

Competing Packages A term used to define a set of potential water management alternatives formulated to address water supply reliability needs for environmental, urban, agricultural, and other uses.

Conceptual Model An explicit description of the critical cause-and-effect pathways in ecosystem function. A conceptual model includes a summary of current knowledge and hypotheses about ecosystem structure and function, and highlights key uncertainties where research might be necessary. Alternative or competing conceptual models illustrate areas of uncertainty, paving the way for suitably-scaled experimental manipulations designed both to restore and explore the ecosystem. Conceptual models also help to define monitoring needs, and bases for quantitative modeling.

Conjunctive Use The operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the ground water basin for later use in place of or to supplement surface supplies. Water is stored by intentionally recharging the basin during years of above-average water supply.

Conveyance A pipeline, canal, natural channel or other similar facility that transports water from one location to another.

Critical Period The most severe drought period of record.

Cross Delta Flow Net combined flow through the channels that carry Sacramento River and San Joaquin River water from the Sacramento area to the Central Delta.

Delta Simulation Model II (DSM2 or DWRDSM2) A computer model (developed by DWR) of the river, estuary, and land processes in the Delta that include hydrodynamics, water quality, and particle tracking analysis capabilities.

Delta Cross Channel Existing gated structure and channel connecting the Sacramento River at Walnut Grove to the North Fork Mokelumne River. The facility was constructed as part of the CVP to enhance movement of Sacramento River water into the central Delta and to the south Delta export pumps. Operating criteria currently require the gates to be closed for specific periods to keep downstream migrating fish in the Sacramento River and to prevent flooding of the central Delta.

Delta Inflow The combined water flow entering the Delta at a given time from the Sacramento River, San Joaquin River, and other tributaries.

Delta Islands Islands in the Sacramento-San Joaquin Delta protected by levees. Delta Islands provide space for numerous functions including agriculture, communities, and important infrastructure such as transmission lines, pipelines, and roadways.

Delta Outflow The net amount of water (not including tidal flows) at a given time flowing out of the Delta towards the San Francisco Bay. The Delta outflow equals Delta inflow minus the water used within the Delta and the exports from the Delta.

Demands The amount of water sought by specific water users.

Demand Management Programs that seek to reduce demand for water through conservation, rate incentives, drought rationing, and other activities.

Department of Water Resources Simulation Model (DWRSIM) Simulates the interactions between the system of rivers, reservoirs, and export structures that are part of the State Water Project, Central Water project, and local water supply projects.

Direct Mortality The direct loss of fish associated with facilities (forebay, fish screens, and salvage facilities) for the south Delta export pumps. This direct mortality is a portion of the total fish mortality resulting from operation of the export pumps (see indirect morality).

Diversions The action of taking water out of a river system or changing the flow of water in a system for use in another location.

Drought Conditions A time when rainfall and runoff are much less than average. One method to categorize annual rainfall is as follows, with the last two categories being drought conditions: wet, above normal, below normal, dry, critical.

Delta Simulation Model II (DSM2) A computer model of river, estuary and land processes in the Delta that are combined in a package of three main modules: hydrodynamics, water quality, and particle tracking.

Dry Years The average of all the dry and critical water years as defined by the Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index. The type of water year (for example, wet, normal, dry, critical) is based on this index, and the definition of this index can be found in the May 1995 State Water Resources Control Board Water Quality Control Plan for the San Francisco Bay / Sacramento-San Joaquin Delta Estuary.

DWR Department of Water Resources, the State of California's water resource agency.

Ecosystem A recognizable, ecological community, taken as a unit, that includes organisms, their environment, and the interactions among them.

Entrainment The incidental drawing of fish into water diversion facilities, resulting in the loss of such fish.

Environmental Water Account (EWA) A method of accounting for the water and financial assets that can be managed to provide additional protections for fishery resources beyond prescriptive standards.

ESA (Endangered Species Act) Federal and State (CESA) legislation that provides protection for species that are in danger of extinction.

Export Water diversion from the Delta used for purposes outside the Delta.

Export-Inflow Ratio (E-I Ratio) This requirement presently limits Delta exports by the State and federal water projects to a percentage of Delta inflow. In July through January, 65 percent of inflow can be exported. During February through June, months most critical to fisheries, the allowable E-I ratio is reduced to 35 percent to help diminish reverse flows and the resulting entrainment of fish caused by south Delta export operations.

Fish Entrainment The incidental capture and loss of fish during water diversion.

Ground Rules Within the Water Management Strategy Evaluation Framework, the assumptions that reflect both external and real-world constraints within which alternatives must function.

Groundwater Banking Storing water in the ground for use to meet demand during dry years.

In-lieu Groundwater Banking replaces groundwater used by users with surface water to build up and save underground water supply for use during drought conditions.

Hydrograph A chart or graph showing the change in flow over time for a particular stream or river.

In-Delta Storage Water storage within the Delta by converting an existing island to a reservoir.

The storage can help facilitate flexible operations of the export pumps by allowing export of stored water when critical fish species are present in the south Delta.

Indirect Mortality The indirect fish losses from operating the Delta Cross Channel and south Delta export pumps. For example, fish diverted from the Sacramento River into the central and south Delta experience higher mortality through increased stress, small agricultural water diversions, poor water quality, predation, reduced shallow water habitat for fry, higher water temperatures, and higher residence times. This indirect mortality is a portion of the total fish mortality resulting from operation of the export pumps (see direct morality).

Land Fallowing/Retirement Allowing previously irrigated agricultural land to temporarily lie idle (fallowing) or purchasing such land and allowing it to remain out of production for a variety of purposes for a long period of time.

Least-Cost Planning Simulation Model (LCPSM) A computer model designed to measure the economic feasibility of increasing urban water supply reliability by comparing the costs of water reliability improvement options to the costs of shortages.

MAF An abbreviation for million acre-feet, as in 2 MAF or 2,000,000 AF; 10,000 cfs flowing for a year is about 7 MAF.

No Action Alternative The future no action alternatives are assumed possible future scenarios if no WMSEF potential projects and / or actions are implemented.

Performance Measures Performance measures are information sets identified by stakeholders as an aid to decision making when assessing competing water management packages or alternatives. Performance measures are established in advance to ensure a fair decision-making process. It is preferable that performance measures be quantifiable (for example, thousands of acre-feet, dollars, etc.). Within the CALFED solution area, the performance measures may be indicators for a specific site, region, or the entire system.

Planning Assumptions The ground rules are the planning assumptions within WMSEF. The planning assumptions set the context within which the alternatives are expected to perform. They reflect the external conditions and / or constraints imposed on the analysis. Examples are hydrology; baseline demands, Delta standards, and regulatory requirements.

QWEST A broad indication of the net direction and quantity of flow in the San Joaquin River at Jersey Point. This is only an indicator since net flow is not measurable at this location. Considerable tidal exchange at this point is not included because QWEST is an estimate of net flow conditions. A positive QWEST indicates the net flow is generally in the downstream direction towards the San Francisco Bay; a negative number indicates that the net flow is generally in the upstream direction to the east. Generally, a positive QWEST is desirable for Delta flow circulation, water quality, and fisheries.

Real-Time Monitoring and Operations Continuous observation in multiple locations of biological conditions on site in order to improve management to protect fish species and allow optimal operation of the water supply system. This monitoring is an essential feature to allow flexible operations of the export pumps.

Record of Decision (ROD) A framework of action agreed to by the 18 CALFED agencies. The framework defines the long-term plan for restoring ecological health and improving water management in the Bay-Delta system. The ROD establishes deadlines and commitments for each of the key elements of the Program.

Resource Mixes Combinations of water management and facility options used in the Water Management Strategy Evaluation Framework analysis. Resource Mix A incorporates intensive demand side management to keep Delta exports at current levels and adds no new surface storage facilities. Resource Mix B assumes Delta exports will increase, incorporates new surface storage, and allocates supply benefits to urban users as the first priority. Resource Mix C also includes increased Delta exports and new surface storage, with the supply benefits allocated in the same priority as existing water contracts.

Regions The Water Management Strategy Evaluation Framework analyses are performed in the following linked regions: Sacramento basin, San Joaquin basin, Bay-Delta, Tulare, and Central and South Coast regions.

Riparian The land adjacent to a natural water course such as a river or stream. Often supports vegetation that provides important wildlife habitat or fish habitat values when growing large enough to overhang the bank.

Report Card Within the Water Management Strategy Evaluation Framework, the analysis results predict values of an established set of performance measures for a given alternatives which becomes the report card for that alternative.

Stakeholders People or groups with a vested interest in the resolution of the problems and issues associated with the Bay-Delta system; stakeholders are often active participants in the decision-making process.

Solution Principles Fundamental principles that guide the development and evaluation of CALFED Program alternatives. They provide an overall measure of acceptability of the alternatives.

South-of-Delta Storage Water storage supplied with water exported south from the Delta.

State Water Project (SWP) A State of California water storage and conveyance system that that provides water to agricultural, urban, and industrial users in California. The SWP was authorized by legislation in 1951.

TAF An abbreviation for thousand acre-feet, as in 125 TAF equals 125,000 AF.

Tools Defined within the CALFED Water Management Strategy Evaluation Framework context as measures and actions (such as transfers, storage, operations, policies, or programs) used to address identified water supply reliability problems.

Tracy Pumping Plant The CVP export pumping plant in the south Delta.

Terrestrial Species Types of species of animals and plants that live on or grow from the land.

Upstream Storage Any water storage upstream of the Delta supplied by the Sacramento or San Joaquin Rivers or their tributaries.

USBR U.S. Bureau of Reclamation, the federal water resource agency.

Water Budget An accounting of all the water entering, leaving, or stored in a defined system.

Water Conservation Those practices that reduce the consumptive use of water. The extent to which these practices actually create a savings of water depends on the total or basinwide use of water.

Water Management Strategy A major component of the CALFED Program established to evaluate and compare various tools and approaches for addressing water supply reliability in the Bay-Delta system.

Water Management Strategy Evaluation Framework Under CALFED's Water Management Strategy, a set of integrated procedures and analytical tools designed to assist in the relative comparison and evaluation of specific water management actionsor combinations of actions. A decision analysis process for evaluating the performance of potential and implemented water supply reliability actions.

Water Management Program A CALFED program with the goal to improve water supply reliability by reducing the mismatch between Bay-Delta water supplies and current and project beneficial uses dependent on the Bay-Delta system.

Water Reclamation Also called water recycling: practices that treat and reuse water. The waste water is treated to meet health and safety standards depending on its intended use.

Water Transfers Voluntary water transactions conducted under state law and in keeping with federal regulations.

Watershed An area that drains to a particular channel or river, usually bounded peripherally by a natural divide of some kind such as a hill, ridge, or mountain.

Water Year Types The type of water year (for example, wet, normal, dry, critical) is based on the Sacramento Valley 40-30-30 Water Year Hydrologic Classification Index. The definition of this index can be found in the May 1995 State Water Resources Control Board Water Quality Control Plan for the San Francisco Bay / Sacramento-San Joaquin Delta Estuary.

Wheeling The delivery of water through conveyance facilities owned by a separate entity; such delivery usually involves payment to the owner of the facility for its use.

X2 The location (measured in kilometers upstream from the Golden Gate Bridge) of 2 parts per thousand total dissolved solids. The length of time X2 must be positioned at set locations in the estuary in each month is determined by a formula that considers the previous month’s inflow to the Delta and a “Level of Development” factor, denoted by a particular year. X2 is currently used as the primary indicator in managing Delta outflows. The X2 indicator is also used to reflect a variety of biological consequences related to the magnitude of fresh water flowing downstream through the estuary and the upstream flow of salt water in the lower portion of the estuary. The outflow that determines the location of X2 also affects both the downstream transport of some organisms and the upstream movement of others and affects the overall water operations of the CVP and SWP.